Climate Risk Index

Climate Risk Index 2025

Who suffers most from extreme weather events?

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IKI INTERNATIONAL CLIMATE INITIATIVE

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Contents

List of abbreviations

AF	Adaptation Fund
AR6	IPCC Sixth Assessment Report
BRICS	Brazil, Russia, India, China, South Africa
C3S	Copernicus Climate Change Service
COP	Conference of the Parties
CRI	Climate Risk Index
DPO	UN Department of Peace Operations
DPPA	UN Department of Political and Peacebuilding Affairs
EM-DAT	Emergency Events Database
FRLD	Fund for responding to Loss and Damage
GBV	Gender based violence
GDP	Gross domestic product
GGA	Global Goal on Adaptation
GHG	Greenhouse Gas emissions
HDI	Human Development Index
ICJ	International Court of Justice
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
L&D	Loss and Damage
LDCs	Least Developed Countries
LLDCs	Least Developed Land-Locked Countries
MHEWS	Multi Hazard Early Warning Systems
NAPs	National Adaptation Plan
NCQG	New Collective Quantified Goal
ND GAIN	Notre Dame Global Adaptation Initiative
NDCs	Nationally Determined Contributions
PPP	Purchasing Power Parity
SB	Subsidiary Bodies
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
UNDP	UN Development Programme
UNDRR	United Nations Office of Disaster Risk Reduction
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNGA	UN General Assembly
UNOCHA	United Nations Office for Humanitarian Assistance
UNSG	United Nations Secretary-General
WMO	World Meteorological Organization

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Key Messages

I. The Climate Risk Index (CRI) ranking indicates that, in 1993–2022, **Dominica, China, and Honduras** were the countries most affected by extreme weather events' impacts.

II. The ranking shows **Pakistan, Belize, and Italy** as the most affected by extreme weather events' impacts in 2022.

III. From **1993 to 2022, 765,000+ people died worldwide and direct losses of nearly USD 4.2 trillion (inflation-adjusted)** directly resulted from 9,400+ extreme weather events.

IV. **Floods, storms, heat waves, and drought** were the most prominent impacts from short- and long-term perspectives. From 1993 to 2022, storms (35%), heat waves (30%), and floods (27%) caused the most fatalities. Floods were responsible for half of the people affected. Storms caused, by far, the most significant economic losses (56% or USD 2.33 trillion inflation-adjusted), followed by floods (32% or USD 1.33 trillion).

V. The most affected countries in the long-term index for 1993–2022 can be divided into two groups: (1) Countries most affected by highly unusual extreme events **(e.g. Dominica, Honduras, Myanmar, Vanuatu)** and (2) countries affected by recurring extreme events **(e.g. China, India, the Philippines)**. Climate science clearly shows that climate change increases the risk for both categories and contributes to transforming uncommonly extreme events into continual threats, creating a 'new normal.'

VI. **The CRI shows that all countries are affected.** Seven of the 10 most affected countries in 2022 belonged to the high-income country group[1]. This clearly indicates that, while the coping capacities of high-income countries significantly exceed those of lower-income countries, higher-income countries should also increase their climate risk management. Over the long term, the ranking shows that extreme weather events' impacts particularly affect Global South countries. With five countries, the lower middle-income group is the largest country group among the 10 most affected countries, including three Small Island Developing States/Least Developed Countries, where coping capacities are significantly lower.

VII. The CRI ranking is based on the best publicly available historical data set on the extreme weather events' impacts. **Extreme weather events and their impacts are often underreported in Global South countries** because of data quality and coverage challenges and data gaps. As a result, this ranking may less accurately capture these impacts and, therefore, how Global South countries are affected.

VIII. Human-induced climate change affects the frequency and intensity of extreme weather events and leads to widespread adverse climate impacts. The latest climate science and significantly improved attribution science suggest climate change's influence on extreme weather events is 'on the same level of scientific confidence as the statement that human influence has warmed the climate.' [2]

IX. COP29 failed to deliver an ambitious New Collective Quantified Goal (NCQG) on Climate Finance. Considering the identified needs, and the great urgency of the climate challenges that developing countries face, the USD 300 billion annually by 2035 can only be seen as the bare minimum response to the escalating climate crisis. The NCQG also failed to include measures to address loss and damage. This gap must be filled as soon as possible. This situation is even more worrying given the extensive gaps in adaptation finance compared with the needs and commitments (even if progress was made). Substantially increased support by high-emitting countries and other polluters is needed for the most vulnerable in addressing climate impacts.

X. The CRI shows that a **lack of ambition and action in mitigation leads to being strongly affected,** even in high-income countries. It is in the interest of high-income and highly emitting countries to ramp up mitigation action, including higher climate targets and such action's implementation, with new nationally determined contributions (NDCs), to stay below (or as close as possible to) 1.5°C warming and keep impacts at a manageable scale.

1 World Bank 2024.
2 Otto 2023a.

1 Introduction

Scorching heat, heavy rainfalls, raging wildfires, deadly floods, and devastating storms – the manifestations of extreme weather events have become an all-too-common new reality worldwide.

As humanity navigates this warming planet's rising tides and intensifying fires, the impacts of extreme weather events are already reshaping economies, societies, and ecosystems at an alarming pace. This year's relaunch of the Climate Risk Index (CRI) underscores the severe toll of inaction and underscores the escalating human and economic costs. From 1993 to 2022, more than 765,000 people lost their lives worldwide and direct losses of nearly USD 4.2 trillion (inflation-adjusted) directly resulted from more than 9,400 extreme weather events.

The great number of such events in 2024 is a sobering illustration of the climate crisis' new phase, as extreme events have become the 'new normal.' In the Amazon, the worst wildfires since 2005 consumed 22 million hectares—an area almost the size of the entire United Kingdom. Torrential rains and flooding in Brazil, which is set to host COP30, displaced more than 580,000 people and claimed many lives. Deadly heat waves swept across Asia, the Mediterranean, and Mexico, resulting in numerous fatalities and devastating impacts on the population and ecosystems. In September, deadly rains hit West and Central Africa, also bringing fatalities and displacing hundreds of thousands. In the United States, hurricanes Helene and Milton, fuelled by record Gulf of Mexico temperatures, killed hundreds and left trails of destruction. And in October, in just minutes, heavy downpours caused flash floods in eastern Spain, sweeping away nearly everything in their path. More than 200 people died and thousands of livelihoods were devastated.

The World Economic Forum ranked extreme weather events as the second most pressing short-term global risk for 2025, projecting them to become even more severe and the leading threat within the next decade[1]. As the world approaches the +1.5°C temperature threshold sooner than anticipated by the latest Intergovernmental Panel on Climate Change (IPCC) report, the associated irreversible impacts and risks are increasingly evident[2] and disproportionately affecting the most vulnerable people and countries. These climate impacts, both from extreme events and slow-onset processes, could fundamentally reshape societal trajectories.[3] Moreover, there are increasingly clear indications that we are entering a 'critical and unpredictable phase'[4] of the climate crisis. It is critical because in the past two years, various historical air and sea surface temperature records and ice extent records have been broken many times over.[5] The Earth recorded its hottest day ever on 22 July 2024, and 2024 was the hottest year ever recorded and the first year with an average temperature above 1.5°C (Copernicus 2025). The years 2023 and 2024 were, by far, the two years with the highest ever global sea surface temperatures.[6],[7] As anthropogenic global warming continues, critical climate systems are at risk of approaching tipping points.[8] Regarding the possibility of self-reinforcing feedback effects and

1 World Economic Forum 2024.
2 Kotz et al. 2024.
3 Lam and Majszak 2022.
4 Ripple and Wolf 2024.
5 ibid.
6 Copernicus 2024.
7 Copernicus 2023.
8 McKay et al. 2022.

the consequences of tipping points, however, science can only give scenario probabilities and not a single, definite prognosis. Current studies show the North Atlantic is already weakened from climate change and may be approaching a tipping point.[9] Similarly, some major coral reefs may already have passed their tipping points and certain coral species are now living at or near their thermal limits because of their narrow temperature tolerance.[10] For forest systems, the possibility of the Amazon forest soon reaching a tipping point, triggering large-scale collapse of the forest, has raised global concern.[11] Studies have concluded that such a collapse is unlikely within the 21st century, but interactions and synergies among disturbances (e.g. frequent extreme hot droughts and forest fires) could trigger unexpected ecosystem transitions even in the forest system's remote and inner parts.[12]

Projections of economic losses due to climate change are also highly alarming. By 2050, climate change could cost the global economy up to USD 38 trillion annually. This cost is primarily through losses in agriculture, infrastructure, and public health.[13] In absolute and relative terms, the Global South[14] is particularly affected. Income losses in countries least responsible for climate change are likely to be 60% higher than in higher-income countries. Increasing climate change impacts primarily result in increased costs for adaptation and addressing loss and damage (L&D). The UN Environment Programme (UNEP) Adaptation Gap Report 2024 indicates USD 215–387 billion is needed annually for effective adaptation. Moreover, current estimates of climate finance needs for residual L&D in developing countries were USD 116–435 billion in 2020, rising to USD 290–580 billion in 2030, USD 551–1,016 billion in 2040, and USD 1,132–1,741 billion in 2050.[15],[16] Beyond economic losses, the geopolitical impacts on human security are also becoming more pronounced. In regions already vulnerable to conflict, such as East Africa, climate impacts are exacerbating existing challenges, with effects such as human insecurity, resource competition, and social tensions.

However, the path forward is not without hope. Effective climate adaptation and disaster risk management strategies have successfully reduced risks. Examples exist from around the world. Owing to effective risk prevention and adaptation, cyclone-related mortality in Bangladesh has fallen more than 100-fold in the last 40 years, from 500,000 deaths in 1970 to 4,234 in 2007. In Ahmedabad, India, a deadly heat wave in 2010 spurred a Heat Action Plan, which has saved lives and been replicated by more than 30 other Indian cities.[17] These examples highlight the potential of targeted, localised adaptation and disaster risk management strategies to reduce climate-related deaths, build resilience, and alleviate economic burdens.

The CRI findings, viewed in this broader context, are a call to action and a reminder of the heavy toll extreme weather events are inflicting on communities and nations worldwide. Despite the urgent need for change, ambition for reducing emissions is alarmingly low. Fossil fuel companies and states continue to make billions in profit each day,[18] only to reinvest it into fossil operations and lobbying to undermine climate action. Phasing out fossil fuels remains the first line of defence in the face of escalating climate impacts. Nations must

9 Schultheiß 2023a.
10 Schultheiß 2023b.
11 IPCC 2021a.
12 B.M. Flores et al. 2024.
13 Kotz et al. 2024.
14 **Disclaimer on the use of country grouping terms.**
1) The term 'Global South' has no fixed definition, nor is there a definitive list of countries it comprises. Referencing the G77 – a coalition of 134 nations in Latin America, Africa, Asia, and Oceania – which collectively refers to itself as the Global South is one way to identify such countries. In this report, the use of Global South is a deliberate effort to decouple the discourse on development from traditional, unsustainable growth models. However, it does not suggest that all traditionally classified developing countries are homogenous or can be grouped into one category. Instead, the term highlights a shared set of vulnerabilities and challenges these countries face, despite their vast economic, social, and political differences.
2) UNFCCC Context: When referring to developed and developing countries in the context of the UNFCCC, the distinction follows the Annexes classification, though this is solely for referencing purposes. 3) For the CRI results analysis, an income-based classification is applied, using the World Bank classification (July 2024) of low, lower-middle, upper-middle, and high-income groups. Using economic distinction is methodologically relevant, as the degree of economic effect is a key indicator in the CRI.
15 Markandya/ González-Eguino 2018: L&D finance needs estimates are based on a scenario where equilibrium temperatures rise by 2.5 to 3.4°C.
16 Markandya and González-Eguino 2018.
17 Gee 2019.
18 Carrington 2022.

immediately halt new fossil fuel projects, eliminate fossil fuel subsidies, and strengthen their commitments, such as by tripling renewable energy capacity, doubling energy efficiency by 2030, and drastically reducing methane emissions. In parallel, adequate climate finance and support for the most vulnerable countries are essential for ensuring resilience and equity amid escalating climate impacts.

1.1 Qualifier: How to read the Index

The CRI analyses how climate-related extreme weather events affect countries and, thereby, measures the consequences of realised risks for countries. This backward-looking index ranks countries by their economic and human effects (fatalities and affected, injured, and homeless people) with the most affected country ranked highest. The CRI aims to visualise how extreme weather events affected countries at a point two years before publication[19] and over the preceding 30 years. Because of limited data availability on economic and human effects, it is not possible to include slow-onset processes in this index. The index is based on data from the EM-DAT international disaster database, World Bank, and International Monetary Fund (IMF). It examines absolute and relative impacts to create a country ranking based on six indicators: economic losses, fatalities, affected people – absolute and relative (see chapter 6 for further details on the methodology).

The CRI aims to contextualise international climate policy debates and processes with a view to the climate risk countries are facing. This index simplifies the aggregation and understanding of climate-related extreme weather events' impacts across different regions and periods. The countries that extreme weather events most strongly impact are ranked highest and should consider the CRI results as a warning sign of their being at risk of frequent events or rare and extraordinary extreme events.

Climate science and significantly improved attribution science clearly show that climate change is affecting the intensity, frequency, and duration of many extreme events. Such events' impacts on, for example, economic costs and human health, also can more clearly be attributed to climate change.[20]

19 Due to the methodological revision, this CRI edition is published in February 2025.
20 Otto 2023a.

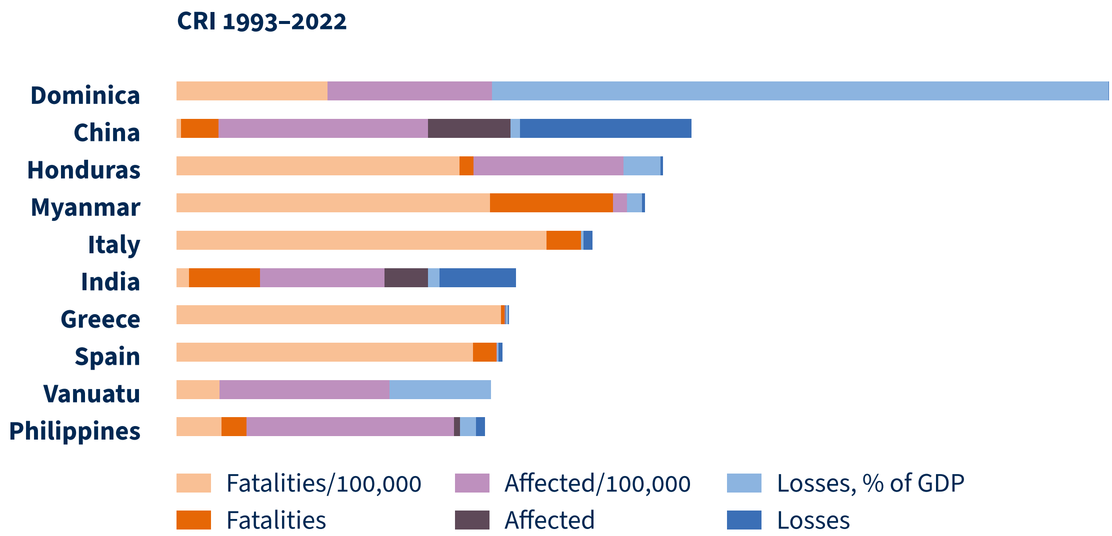
2
Key results of Climate Risk Index 2025

Climate change's consequences are visible worldwide, manifesting in the increased intensity and severity of extreme weather events. Between 1993 and 2022, more than 9,400 such events directly caused more than 765,000 lost lives worldwide and direct losses of nearly USD 4.2 trillion (inflation-adjusted).

2.1 Countries most affected in 1993–2022

Dominica, China, and **Honduras** were the most affected countries from 1993 to 2022, followed by **Myanmar, Italy,** and **India.** Figure 1 shows the 10 most affected countries in the three-decade period, with their specific results for the six indicators analysed.

Figure 1: The 10 countries most affected in 1993–2022



Dominica (1st) ranks highest because of its high relative economic losses, as well as high relative fatalities and affected people. The island is regularly affected by tropical cyclones, such as Hurricane Debby in August 2000, Hurricane Omar in October 2008, Tropical Storm Erika in August 2015, Hurricane Maria in 2017, and Hurricane Dorian in August 2019. Dominica is one of the more hurricane-prone countries in the Caribbean, averaging a damaging storm about every two years. Hurricane Maria was exceptionally severe, causing damage up to USD 1.8 billion, equalling 270% of the small island's gross domestic product (GDP).

China (2nd) ranks second because of its high absolute loss and high relative numbers of affected people. China also shows considerably high numbers for absolute fatalities and people affected. China has faced numerous extreme weather events with substantial societal, economic, and environmental impacts. Recurrent major floods, especially along the Yangtze River, have caused extensive damage, including the 1998 and 2016 floods that displaced hundreds of thousands and devastated agriculture and infrastructure. The country's coastal regions have endured powerful typhoons, such as Typhoon Fred in 1994 and Typhoon Saomai in 2006, which caused severe destruction and loss of life, with storm surges and landslides compounding the damage. Heat waves in northern and eastern China led to water shortages and wildfire risks, while droughts, such as in 1994, reduced crop yields and strained water resources in heavily populated areas. There were more than 600 extreme weather events during the examined period, resulting in losses of USD 706 billion (adjusted for inflation) and at least 42,000 fatalities.[21]

Honduras' rank (3rd) owes to its high number of relative fatalities and affected people, and its absolute fatalities and relative losses. Honduras is one of the poorest countries in the Western Hemisphere and vulnerable to climate change because of its high exposure to climate-related hazards (hurricanes, tropical storms, floods, droughts, and landslides) that devastate crops and critical infrastructure. In 1998, Hurricane Mitch destroyed an estimated 70% of the country's crops and infrastructure, causing more than 14,000 deaths and USD 7 billion in damage, significantly setting back the country's development process.[22]

Myanmar (4th) has had exceptionally high absolute and relative numbers of fatalities. Smaller contributions to its ranking come from the relative values of affected people and economic losses. Myanmar is at risk of several natural hazards, including extreme temperatures, drought, cyclones, flooding and storm surges, and heavy rainfall events. Extensive flooding continues to overwhelm and displace populations in several regions. Cyclone Nargis in 2008 was particularly devastating, killing nearly 140,000 people in floods after the torrential rainfall. The event caused USD 5.7 billion in damage.

Italy (5th) ranks high mainly due to its high absolute and relative numbers of fatalities. The country has faced several extreme heat waves, especially in the previous 20 years, causing severe human and economic losses. The years 2003 and 2022 were notable for their exceptionally high numbers of fatalities associated with scorching temperatures and damage from droughts, wildfires, decreased agricultural productivity, infrastructure damage, and the strain on health services and energy grids. Heavy flooding, especially along the Po River, caused extensive damage, such as in the 1994 and 2000 Piedmont floods. Overall, Italy suffered economic losses of nearly USD 60 billion and more than 38,000 fatalities.

India (6th) shows high absolute fatalities and economic losses, as well as high absolute and relative numbers of people affected. The country has faced a variety of increasingly frequent extreme weather events, including floods, heat waves, cyclones, and drought. Floods and landslides resulting from heavy monsoons displaced millions and damaged agriculture. And cyclones devastated coastal areas, underscoring India's diverse climate risks. Notable events included the 1998 Gujarat and 1999 Odisha cyclones, Cyclones Hudhud and Amphan in 2014 and 2020, the 1993 floods in northern India, Uttarakhand floods of 2013, and severe floods in 2019. Recurring and unusually intense heat waves, all with temperatures around 50°C, claimed many lives in 1998, 2002, 2003, and 2015. There were more than 400 extreme weather events in the three decades, causing losses of nearly USD 180 billion (inflation-adjusted) and at least 80,000 fatalities.[23]

Greece (7th) ranks high mainly because of its high absolute and relative number of fatalities. The country experienced a series of floods, wildfires, and heat waves from 1993 to 2022. It was hit especially hard by the highly unusual European heat wave in 2022, which led to widespread deaths. Wildfires – such as in 1998, 2007, and 2022 – have been a recurring threat, affecting livelihoods and causing severe agricultural damage. Total economic losses amounted to more than USD 7 billion over the 30-year period and more than 3,400 people lost their lives.

Spain (8th) also ranks high mainly because of its high absolute and relative terms number of fatalities. From 1993 to 2022, the country experienced many extreme heat waves, which led to substantial human and economic impacts. The years 2003 and 2022 were marked

21 Centre for Research on the Epidemiology of Disasters 2024.
22 World Bank 2024a.
23 Centre for Research on the Epidemiology of Disasters 2024.

by extremely high death tolls due to intense heat, while widespread damage was caused by droughts, wildfires, reduced agricultural yields, infrastructure strain, and overwhelming pressure on healthcare systems. Highly unusual events include the 1999 drought in southern Spain and heavy floods in 2019 in the southeast, resulting in casualties and massive losses to agriculture, property, and infrastructure. Over the three decades, Spain incurred about USD 25 billion in economic losses, with nearly 27,000 fatalities.

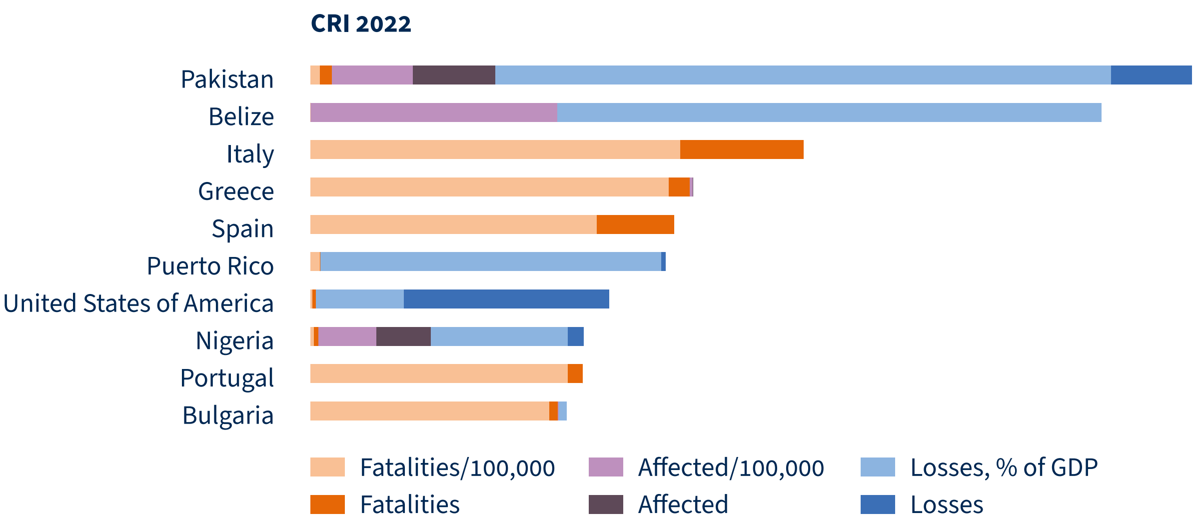
Vanuatu's rank (9th) owes to its high number of relative economic losses and affected people, as well as relative fatalities. As a Pacific island nation, Vanuatu has endured repeated cyclones, which have threatened homes and livelihoods. Cyclone Pam in 2015 was particularly devastating, destroying most food crops and affecting over two-thirds of the country's population.[24] Total damage incurred through Pam alone amounted to nearly USD 580 million, or around 60% of the country's GDP.

The Philippines (10th) ranks high mainly because of its relative number of people affected, accompanied by relative fatalities and economic losses. The Philippines also shows considerably high numbers in absolute terms. Because of its geographical location, the archipelagic country is regularly hit by typhoons, such as Ketsana in 2009, Bopha in 2012, Hayan in 2013, Mangkhut in 2018, and Goni in 2020. Typhoon Haiyan in 2013 was the strongest recorded typhoon in the Philippines and one of the strongest ever recorded globally, killing more than 7,000 people, devastating nine regions, and resulting in 1.1 million homes damaged and agricultural and infrastructure damage of USD 802 million.[25] Total damage from Hayan alone amounts to USD 13 billion. Apart from these exceptionally devastating typhoons, the Philippines was hit by multiple other tropical cyclones in every year between 1993 and 2022, making these events a continuous threat. A total of 372 extreme weather events in 1993–2022 caused USD 34 billion in (inflation-adjusted) losses.[26]

2.2 Countries most affected in 2022

The CRI ranking indicates **Pakistan, Belize,** and **Italy** were the most affected countries in 2022, followed by **Greece, Spain,** and **Puerto Rico**. Figure 2 shows the 10 most affected countries in 2022, with the specific results relating to the six CRI indicators analysed.

Figure 2: The 10 most affected countries in 2022



Pakistan (1st) ranks highest mainly because of exceptionally high relative economic losses. Also, in absolute terms, economic losses were high, as well as the numbers of affected people in absolute and relative terms. Pakistan suffered from devastating floods, landslides, and storms from June to September 2022 owing to a

24 Reliefweb 2015.
25 World Bank 2024b.
26 Centre for Research on the Epidemiology of Disasters 2024.

heavy monsoon season with torrential rainfalls. The floods, described as the worst in the country's history, affected more than 33 million people, leading to more than 1,700 fatalities and causing accumulated damage of nearly USD 15 billion.[27] A national state of emergency was declared on 25 August 2022 because of the flooding, as 10% of the country was inundated.[28] In October 2022, the World Bank estimated reconstruction would cost over USD 16 billion,[29] making this one of the costliest disasters in world history. Climate change likely increased extreme monsoon rainfall by 50%, flooding vulnerable communities in the country.[30]

An intense heat wave spanning March to the end of May 2022, reaching record temperatures of 49.5°C in the city of Nawabshah, immediately preceded the severe floods.[31] The extreme temperatures, which also spread to India and Bangladesh, claimed more than 90 lives across the three countries. A real-time extreme event attribution study by the World Weather Attribution project showed that climate change made the heat wave 30 times more likely.[32] This finding underscores the growing significance of compound climate events (Zscheischler et al., 2020).

Belize (2nd) ranks second because of exceptionally high relative economic losses and affected people. Hurricane Lisa (Category 1) hit the country on 2 November 2022, bringing heavy rainfall that caused extensive and destructive flooding across much of the country. Dangriga and Belize City were the most affected regions. The hurricane significantly damaged houses, property, roads, drains, public infrastructure, and livestock.[33] Nearly 5,000 homes were damaged, with more than 172,000 people affected, many of whom sought refuge in state-managed shelters.[34] The economic loss was estimated at over USD 104 million.[35]

An extraordinarily persistent heat wave affected **Italy** (3rd), **Greece** (4th), **Spain** (5th), **Portugal** (9th), and **Bulgaria** (10th), and large parts of the European continent. The Copernicus Climate Change Service indicated 2022 had the hottest summer ever recorded in Europe (at that time).[36] For most of southwestern Europe, the average daily temperature in 2022 was the highest recorded since 1950. Periods with unseasonably warm conditions occurred throughout the year, in some cases reaching extreme highs.[37] The prolonged hot and dry weather brought severe drought and wildfires spread across large parts of the continent. The European Drought Observatory called the scorching drought 'the worst in 500 years.'[38]

Italy (3rd) ranks high mainly because of its high number of absolute and relative fatalities. The number of wildfires by the end of June 2022 was three times the average.[39] Rome's temperature reached 40.8°C on 28 June, a record at that time.[40] In July, 16 cities, including Rome, were put under a red state of alert, the country's highest heat wave alert for warning of serious health risks. A state of emergency was declared in five northern regions in response to a severe drought in the Po Valley, the worst in 70 years, and later for Tuscany.[41] Scientists concluded that the 2022 Po River drought was the worst of the last two centuries and highly like-

27 ibid.
28 Unosat 2022.
29 World Bank 2022.
30 Otto et al. 2022.
31 Centre for Research on the Epidemiology of Disasters 2024.
32 World Weather Attribution 2022a.
33 Reliefweb 2023.
34 Reliefweb 2022.
35 Centre for Research on the Epidemiology of Disasters 2024.
36 Copernicus 2022b.
37 Ibid.
38 BBC 2022.
39 The Local Italy 2022.
40 Centre for Research on the Epidemiology of Disasters 2024.
41 The Guardian 2022.

ly to have been triggered by global warming.[42] More than 18,000 heat wave-related deaths were estimated for Italy .[43]

Greece's rank (4th) owes to its high number of fatalities, especially in relative terms. Extreme heat reaching 42.1°C, such as in the city of Phthiotis, hit Greece during the summer months, claiming more than 3,000 lives.[44] Greece also experienced wildfires in several regions during July 2022, affecting 55,000 people.[45]

Spain (5th) ranks high mainly because of its high absolute and relative number of fatalities. In 2022, the country suffered from forest fires in many regions due to extreme heat lasting from mid-June to mid-July, with a total of 3,500 people affected.[46] The scorching heat reached temperatures as high as 43.2°C, leading to more than 11,000 fatalities.[47] The early June temperatures were the highest recorded in at least 20 years[48] and severely impacted harvests, as grain and olive crops dried up.

Puerto Rico[49] (6th) shows high numbers for relative economic losses. The country was severely hit by Hurricane Fiona in September 2022, which made landfall along the island's southwestern coast. The country suffered its worst flooding since Hurricane Maria in 2017, leading to an island-wide blackout.[50] Fiona's torrential rainfall stripped road pavement, tore roofs off houses, and washed away at least one bridge. One million people, about 33% of the population, were left without drinking water[51] and the hurricane caused 25 fatalities and damage up to USD 2.6 billion.

The **United States** (7th) ranks high because of high absolute and relative economic losses. Hurricane Ian dealt the country a major blow in September 2022 and was the third costliest tropical cyclone on record worldwide, causing widespread damage in Florida and the Carolinas. Ian claimed almost 150 lives in Florida alone and became the deadliest hurricane to strike that state in almost 90 years.[52] More than 2.4 million people in Florida lost power during and after the storm.[53]

Hurricane Nicole hit the same region just six weeks after Hurricane Ian. Despite being relatively weak, Nicole's large size brought widespread heavy rainfall and strong winds, knocking out power and inflicting significant damage in many areas[54] Eleven people died and economic loss was around USD 1 billion.

A drought accompanied by extreme heat affected all of the United States during 2022, leading to 136 fatalities across the states of Arizona, Nevada, California, Oregon, and Texas. Dozens of temperature records were surpassed. On 1 September, the 53°C recorded in Death Valley marked the hottest September day in world history. The drought was one of the costliest on record, with a range of direct impacts across different regions and industries,[55] causing nearly USD 23 billion in damage.[56]

Winter storm Elliot hit the United States in late 2022, leading to record temperature drops within a very short period. The states of Montana, South Dakota, and Wyoming registered temperatures as low as -43°C.[57] Elliot intensified so strongly that it met the definition of a 'bomb cyclone' or rapid cyclogenesis. Most deaths

42 Chelli 2022.
43 Centre for Research on the Epidemiology of Disasters 2024.
44 Ibid.; Deutsche Welle 2022 a, b, c; Euronews 2022.
45 Centre for Research on the Epidemiology of Disasters 2024.
46 Ibid.
47 Ibid.
48 Burgen 2022.
49 Note: Puerto Rico is not an independent national state but an unincorporated US territory. Nevertheless, based on its geographical location and socio-economic indicators, Puerto Rico has different conditions and exposure to extreme weather events than the rest of the United States. The Global Climate Risk Index aims to provide a comprehensive and detailed overview of which countries and regions are particularly affected by extreme weather events. Therefore, Puerto Rico was considered separately from the rest of the United States in the analysis.
50 Ravipati 2022.
51 AccuWeather 2022a.
52 AccuWeather 2022b.
53 Cohen 2022.
54 Beven and Alaka 2023.
55 NOAA 2024.
56 Centre for Research on the Epidemiology of Disasters 2024.
57 Bushard 2022.

were in traffic accidents or from people freezing in snow-covered vehicles.[58] In the storm's aftermath, nearly 100 people were reported dead.[59] Through the first half of 2022, the United States was also hit by a series of six tornadoes, with winds speeds up to 275 kph. The storms claimed 30 lives and caused over USD 11 billion in total loss.[60]

Nigeria's (8th) rank owes to high values for relative economic losses and absolute and relative numbers of people affected. In 2022, heavy flooding struck the country following torrential rainfalls from July to the end of October. The floods were among the country's worst ever, causing widespread devastation. More than 600 people died, and more than 3.2 million were affected across 34 states. The disaster displaced 1.4 million people, submerged entire communities, and damaged or destroyed more than 300,000 homes. Critical infrastructure, including roads and farmland, was severely impacted, exacerbating food insecurity and economic hardships. Heavy rainfall, worsened by climate change and the release of water from Cameroon's Lagdo Dam, contributed to the crisis. Many areas, such as Kogi, Bayelsa, and Jigawa states, were especially hard hit, with considerable loss of life and displacement. Humanitarian efforts, led by organisations such as UNICEF, provided emergency supplies, medical aid, and support for displaced people.[61],[62] The total damage was estimated at over USD 4.2 billion.[63]

Nigeria also experienced severe drought in 2022, part of a broader climate crisis impacting much of Africa. The drought exacerbated water insecurity in northern regions, including the Sahel, where climate change, conflict, and overuse of resources had already drastically reduced water availability. Millions of children were particularly vulnerable, with many facing malnutrition and an increased risk of waterborne diseases. Nearly 20 million people were affected.[64]

Portugal (9th) shows high absolute and relative numbers of fatalities. Temperatures in the country in 2022 reached 47°C in a period of extreme heat spanning the end of May to the beginning of September. More than 2,000 fatalities[65] were estimated. Portugal was hit by wildfires in several regions in mid-July 2022, leading to three fatalities and 187 injured.[66] The country also experienced drought due to the heat wave beginning in July 2022 and lasting well into the following year.[67]

Bulgaria (10th) experienced high absolute and relative numbers of fatalities, and considerably high relative economic losses. The country also suffered under extreme heat, with persistently high temperatures reaching 39°C in some regions. Health authorities reported a surge in heat-related illnesses, such as heat stroke, hypertension, and dehydration, especially among vulnerable populations, such as older people and children.[68] The death toll was estimated at more than 1,200 people.[69]

2.3 Detailed look at relevant events

The CRI analyses human and economic effects from extreme weather events on countries, including hydrological, meteorological, and climatological events. The greatest effect results from five event types: floods, storms, heat waves, drought, and wildfires. This section analyses which of these events are responsible for how many fatalities, degree of effect, and economic loss.

58 Brand 2022.
59 Centre for Research on the Epidemiology of Disasters 2024.
60 Ibid.
61 CERF 2022.
62 UNICEF 2022.
63 Centre for Research on the Epidemiology of Disasters 2024.
64 Ibid.
65 Ibid.
66 Ibid.
67 Ibid.
68 Grigorova 2022.
69 Centre for Research on the Epidemiology of Disasters 2024.

Table 1: Overview of fatalities, affected people, and economic damage for the six event types in 2022

Hazard	Fatalities[70]	Affected[71] (million)	Economic loss[72] (billion USD, inflation-adjusted)
Drought	2,601	107.35	35.65
Flood	8,050	57.55	46.78
Heat wave	61,782	0.029	0
Storm	1,605	16.98	137.43
Wildfire	76	0.245	1.12
Other	418	0.148	0

Table 2: Overview of fatalities, affected people, and economic damage for the six event types for 1993–2022

Hazard	Fatalities	Affected (billion)	Economic loss (trillion USD, inflation-adjusted)
Drought	25,026	1.87	0.273
Flood	205,000	2.91	1.33
Heat wave	225,600	0.005	0.032
Storm	264,000	0.97	2.33
Wildfire	363	0.018	0.163
Other[73]	43,248	0.105	0.065

Note that some of these five events are connected or interdependent. Compound events, defined as 'a combination of multiple drivers and/or hazards that contribute to societal or environmental risk,' account for many of extreme weather events' most severe impacts;[74] For example, most floods can be linked to a storm.[75] In Belize, for instance, the second most affected country in 2022, a hurricane accompanied by heavy rainfall caused extensive and destructive flooding nationwide. These combined events caused USD 104 million in economic loss that year. Heat waves, drought, and forest fires are also closely related. Extended periods of elevated temperatures with little precipitation can lead to drought conditions. Prolonged drought and heat waves increase the risk of wildfires.[76] Climate change exacerbates the occurrence of compound drought and heat waves.[77] For instance, the 2022 European heat

70 Fatalities include confirmed fatalities directly attributable to the disaster plus missing people whose whereabouts since the disaster are unknown, so they are presumed dead based on official figures. For some events, the proper quantification of fatalities is difficult, especially for heat waves. Most heat-related deaths result from increased risk of less obvious conditions, such as cardiovascular disease. These seemingly indirect deaths are not noted as being 'heat-related' at the time and can only be estimated via retrospective statistical methods (https://ourworldindata.org/disaster-database-limitations).

71 Affected is the total of injured, otherwise affected, and homeless people.

72 No data available for economic loss related to heat wave and other events.

73 Cold wave, severe winter conditions, mass movement, glacier lake outburst flood.

74 Zscheischler et al. 2020.

75 Yangchen 2021.

76 Hufe and Hortig 2022.

77 Wang et al. 2023.

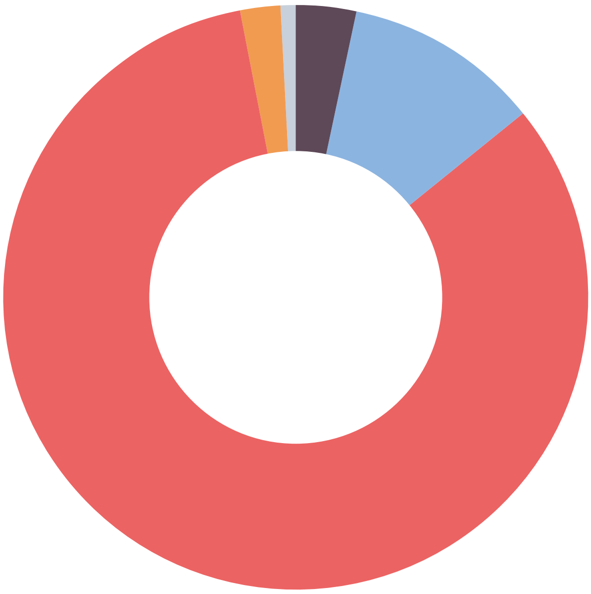
wave caused widespread drought and wildfires across the continent.[78]

Fatalities

Heat waves were, by far, the deadliest extreme weather events in 2022. Table 1 shows heat waves were responsible for 83% of fatalities (61,782) in 2022. Floods (8,050) and drought (2,601) were next.

The 2022 European heat wave was the main cause of high fatalities due to heat waves. An unusually persistent heat wave affected Italy (3rd), Greece (4th), Spain (5th), Portugal (9th), and Bulgaria (10th), and large parts of the European continent.

Figure 3: Fatalities by event in 2022



Fatalities 2022

Data expressed in people

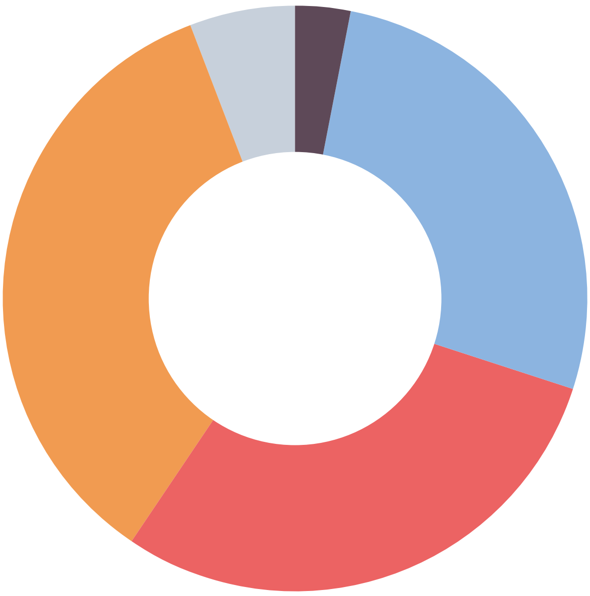
Drought	2.601
Flood	8.050
Heatwave	61.778
Storms	1.605
Wildfires	76
Others*	418

*Cold wave, severe winter conditions, mass movement, glacier lake outburst flood

78 Copernicus 2022c.

From the long-term perspective (1993–2022), storms (35%), heat waves (30%), and floods (27%) caused the most fatalities.

Figure 4: Fatalities by event in 1993–2022



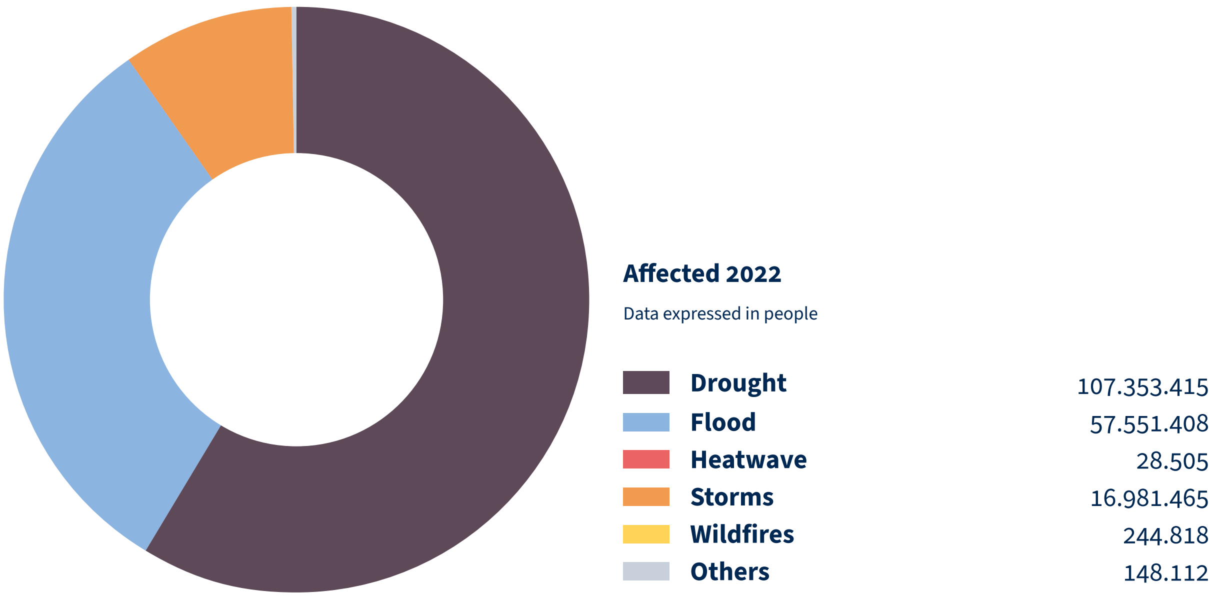
Affected people

Drought led to the largest number of people affected in 2022 (59%; 107 million people). Those in seven African countries (Uganda, Burkina Faso, the Democratic Republic of Congo, Ethiopia, Nigeria, Sudan, and Niger) were particularly affected.

Floods (32%; 57 million people) and storms (9%; 16.98 million) are next. The floods in Pakistan (1st) were especially damaging, affecting more than 33 million people. A total of 8,168,000 people lost their homes and were (internally) displaced,[79] as the floods destroyed 897,014 homes and damaged another 1,391,467.[80],[81] With this, Pakistan had the highest number of people internally displaced by disasters in 2022.[82] A lack of drinking water also led to waterborne diseases, including diarrhoea, cholera, dengue, and malaria, as well as skin infections.[83] In 2023 alone, disaster displaced another 26.4 million people worldwide, while conflict and violence led to another 20.5 million internally displaced.[84]

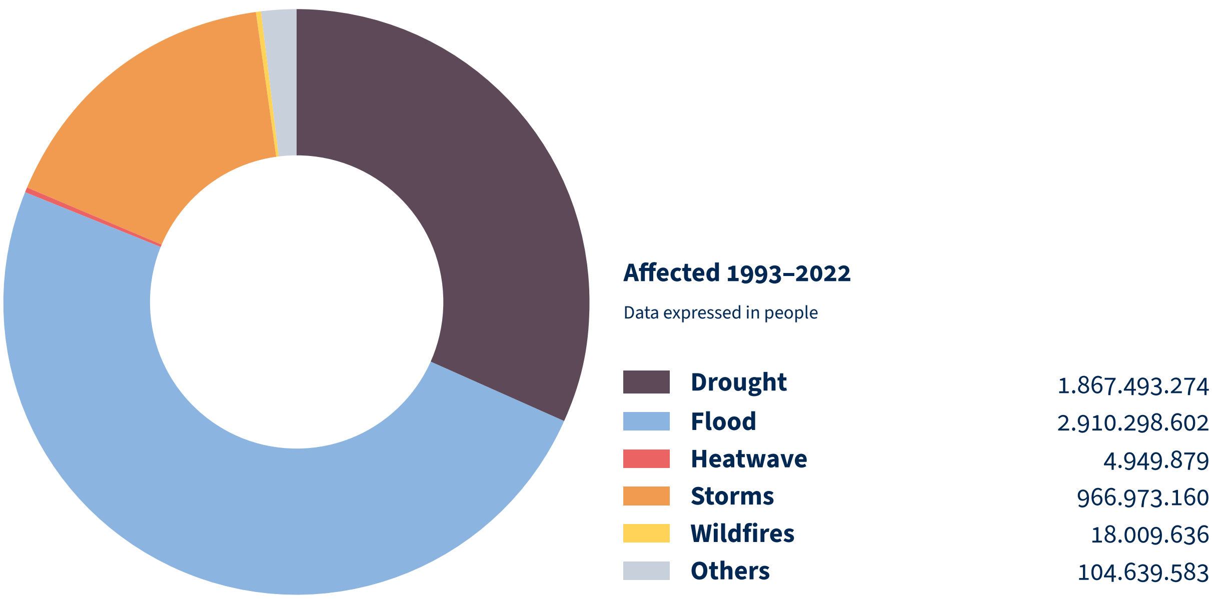
79 Internal Displacement Monitoring Centre 2023.
80 Finance Division Government of Pakistan 2022.
81 Government of Pakistan 2022.
82 Internal Displacement Monitoring Centre 2023.
83 Thomas 2022.
84 Internal Displacement Monitoring Centre 2024.

Figure 5: Number of people affected by event in 2022



In the 30-year perspective, floods were responsible for half of all people affected. This was often due to extreme flood events triggered by heavy rainfall following severe storms, such as in Myanmar in 2008. Drought (32%) and storms (16%) also affected many people.

Figure 6: Number of people affected by event in 1993–2022



Economic loss

The greatest economic loss in 2022 was, by far, due to storms (62%; USD 137.43 billion). Hurricane Ian caused the largest share in the United States (USD 104 billion), making this the costliest extreme weather event of 2022. Floods also caused substantial damage (USD 46.78 billion). Pakistan's worst floods ever, causing nearly USD 15 billion in damage, were also behind its ranking as the most affected country in 2022. Drought (USD 35.65 billion) and wildfire (USD 1.12 billion) also caused massive economic loss.

Figure 7: Economic loss by event in 2022

Economic losses 2022

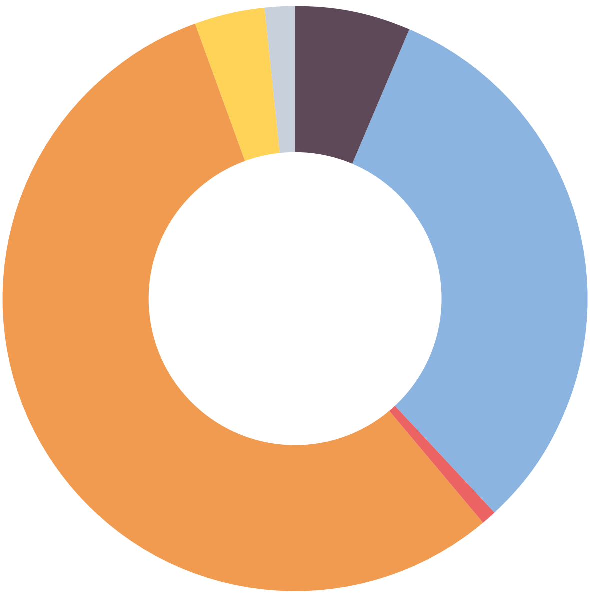
Data expressed in US dollars

Drought	35.649.457.000
Flood	46.777.665.000
Heatwave[1]	0
Storms	137.431.979.000
Wildfires	1.120.292.000
Others	0

1 No data available for economic losses related to heatwaves.

In the 30-year perspective, storms caused, by far, the greatest economic loss (56%; USD 2.33 trillion inflation-adjusted) followed by floods (32%; USD 1.33 trillion).

Figure 8: Economic loss by event in 1993–2022



Economic losses 1993–2022

Data expressed in US dollars

Drought	272.448.564.000
Flood	1.333.859.949.000
Heatwave	31.917.422.000
Storms	2.331.395.947.000
Wildfires	163.409.790.000
Others	65.364.751.000

3

Interpreting the CRI results

3.1 Unusually extreme events, continuous threats, and the new normal

The CRI 2025, covering 1993–2022, is based on annual average values over a 30-year period. Countries covered in the long-term index can be divided into two groups:

1. **Most affected by unusual extreme events**
2. **Affected by recurring extreme events (continuous threats)**

Note that, in this context, CRI results reflect realised risks stemming from heightened exposure to hazards or increased vulnerability, signalling susceptibility to frequent or severe extreme weather events. Dominica, Honduras, Myanmar, and Vanuatu are among countries in the first category (unusually extreme events). In Dominica, Hurricane Maria caused USD 1.8 billion in damage, or 270% of the small island's GDP. In Myanmar, Cyclone Nargis in 2008 caused over 95% of the damage and fatalities over the past **three** decades. These countries are also regularly affected by extreme weather events. There are clear indications that **climate change increases the risk for unusually extreme events.** There are also increasingly clear indications that we are entering a 'critical and unpredictable phase'[85] of the climate crisis. It is critical because, in the previous two years, historical air and sea surface temperature records and ice extent records have been broken many times over.[86] On 22 July 2024, Earth's hottest day ever was recorded, while that February saw unprecedented global sea surface temperatures. It is unpredictable because the possible self-reinforcing feedback effects and the consequences of tipping points cannot be fully assessed scientifically. Studies show the North Atlantic Current is already weakened from climate change and may be approaching a tipping point.[87]

China, India, the Philippines, and Pakistan are among those in the second category (continuous threats). The Philippines, for example, regularly experiences typhoons because of its perilous geographical location. The continuous threats can also include unusually extreme events (e.g. in Pakistan, which, while continuously hit by extreme weather events, suffered from the world's costliest flood ever in 2022). The category of continuous threats has grown more relevant in the past few years. These countries continuously rank among the most affected in the long-term index and the index for the respective year. Also regarding this category are clear indications that climate change **contributes to transforming unusually extreme events into continued threats.** Science can clearly demonstrate climate change's significant effect on the frequency, intensity, and duration of extreme weather events (see chapter 4). Heat waves are a good example. The 2022 heat wave in Western Europe was why Italy, Greece, and Spain ranked high in the index. Though the heat wave and its potential consequences, such as drought and wildfires, are unusual extreme events, Western Europe

85 Ripple et al. 2024.
86 ibid.
87 Biló et al. 2024.

will be continually affected by heat waves.[88] Therefore, what used to be highly unusual threats have become the new normal.

3.2 How Global South and Global North countries are affected

Extreme weather events' impacts affect all countries. The long-term index over 30 years showed an especially strong effect on Global South countries. Five of the 10 most affected countries from 1993 to 2022 (Honduras, Myanmar, India, Vanuatu, and the Philippines; three being Small Island Developing States [SIDS]/least developed countries [LDCs]) were from the lower middle-income group, two (Dominica and China) from the upper middle-income group, and three (Italy, Greece, and Spain) from the high-income group. This is in line with the IPCC Sixth Assessment Report's high-confidence statement that, 'Vulnerable communities who have historically contributed the least to current climate change are disproportionately affected.'[89]

In the 2022 ranking, the picture changes, with two countries (Pakistan and Nigeria) from the lower middle-income group, one (Belize) from the upper middle-income group, and seven countries and territories (Italy, Greece, Spain, Puerto Rico, United States, Portugal, and Bulgaria) with high incomes (five are European countries) in the 10 most affected countries. Considering significance for overall degree of effect, the annual ranking is like a snapshot, while the 30-year index shows a more comprehensive picture.

The high degree of effect on European countries is notable for 2022. The specific meteorological and political backgrounds can help in understanding this situation. In 2022, Europe was hit by an **exceptionally strong heat wave** (see also chapter 2) and, for large parts of Europe, this was the hottest year on record (at that time). In Western Europe, the highest temperatures were about 10°C higher than typical summer maximum temperatures. The heat wave also was marked by a very early first "tropical day" in 2022, which was recorded already in mid-May, one month earlier than usual.[90]

Generally, **Europe is the fastest-warming continent** in the world. Since the 1980s, it has warmed at twice the global average.[91] Thus, highly unusual situations, such as in 2022, are expected to become more frequent. As Tebaldi et al. (2023) found, frequency and intensity of heat extremes can be identified because of an increase in global surface air temperature, and they have already increased (globally) since 1950.[92] In Europe, regular weather patterns are changing. Heat and droughts are increasing, rainfall is declining, and more severe precipitation extremes are occurring, leading to highly unusual flooding.[93] Also, growing food and water insecurity are threatening public health, particularly for outdoor workers, while jeopardising energy and financial security.[94] A large-scale, severe drought has been affecting the western Euro-Mediterranean region. A lack of precipitation during the first two months of 2022, typically part of the wet season, caused dry conditions in the Iberian Peninsula, including Portugal and Spain. This shortfall posed challenges for the region in the later months of the year.[95] Meanwhile, water shortages already affect 30% of the European population each year.[96]

Examples of extraordinary, unprecedented events show that many European countries are **not yet prepared for these events in terms of comprehensive risk management.** There is little focus on prevention and preparedness, and this leads to greater impacts. Even if there is overall progress, preparedness is low and policy implementation is 'lagging substantially behind quickly-increasing risk levels.'[97]

Two recent examples of extraordinary events in Europe underscore this analysis. The **flood event in western Germany around the Ahr River** in July 2021, with 134

88 European Environment Agency 2024a.
89 IPCC 2023.
90 Copernicus 2022a.
91 European Environment Agency 2024b.
92 Tebaldi et al. 2023.
93 EEA 2024b.
94 EEA 2024b.
95 Toreti 2022.
96 EEA 2024b.
97 EEA2024b.

fatalities and 766 people injured, illustrates the lacking early warning system and lack of capacity in authority and population. Already days before the event, an extreme heavy rainfall event was detected to be developing over western and southwestern Germany, according to experts[98]. They also found that on the day of the event, in the afternoon at the latest, it was undoubtedly clear there would be extreme flooding at a scale seen less frequently than every 100 years. Even with the German weather service's warning the day before the event, the state of emergency was declared only very late on the evening of the event. Experts assess the risk management in this case as a systemic failure, as either the warnings were not issued correctly or people did not know how to react properly.[99]

For the **flood event in Spain's Valencia region in October 2024,** similar challenges led to high (especially human) impacts, with more than 200 fatalities. Spain's national weather agency (as in Germany) issued severe warnings well in advance but, at the local level, delayed communication and timely action. People also lacked knowledge on relevant issues, such as evacuation routes. Over half the victims were >70 years old, underscoring that the most vulnerable groups (e.g. older people) are most affected in Europe, as well. Additionally, risk perception in Spain at the national level was comparably low and the risk management approach failed to focus on prevention and preparedness.[100]

In Global North and Global South countries, the **most vulnerable parts of the population are most affected,** such as with food security and health.[101] The IPCC Sixth Assessment Report clearly points out that, 'across sectors and regions the most vulnerable people and systems are observed to be disproportionately affected. The rise in weather and climate extremes has led to some irreversible impacts as natural and human systems are pushed beyond their ability to adapt.'[102] At the micro/household level, poorer households are more vulnerable, more exposed, and need more time to recover, especially in the Global South.[103] Inequality, poverty, and marginalisation because of gender, ethnicity, and low income can further exacerbate vulnerability and, thus, the degree of effect. This is especially true for Indigenous Peoples and local communities, and it hinders adaptation, leading to soft limits and resulting in disproportionate exposure and impacts for the most vulnerable groups.[104]

Apart from extreme events' direct effects on households, there can also be lagged effects, when recovery is incomplete, especially for poorer households. Households in the Philippines have been shown to need years to recover after, for example, a typhoon event, and 90% of their total economic losses occur only in the recovery phase. There is a disproportionate effect because income losses cannot be offset.[105] With the climate crisis advancing, impacts that become L&D will increase and be strongly concentrated among the poorest vulnerable populations.[106]

Apart from vulnerable groups, countries from the Global South are disproportionately affected over the long term, as the CRI ranking shows. The Notre Dame Global Adaptation Initiative (ND GAIN) index combines information on countries' vulnerability[107] and readiness[108] in its ranking. It shows the potential degree of effect and of coping capacities. It echoes the CRI results for the 30-year index, when showing the particular vulnerability of the Global South, and poorer countries specifically, with the lowest 43 ranks (the most vulnerable and least ready) from low or lower middle-income country groups and comprising countries in Africa, Latin America, and Asia-Pacific.[109] As the ND GAIN ranking already indicates, Global South countries' high vulnerability and lack of coping capacity play out in the degree of

98 Süddeutsche Zeitung 2022.
99 ibid.
100 Chavda 2024.
101 EEA 2024a.
102 IPCC 2022b.
103 Sauer et al. 2023.
104 IPCC 2022b.
105 Sauer et al. 2023.
106 IPCC 2022b.
107 Incl. exposure, sensitivity and ability to adapt to the negative impact of climate change.
108 A country's ability to leverage investments and convert them to adaptation actions, considering three components - economic readiness, governance readiness, and social readiness.
109 Notre Dame Global Adaptation Initiative 2024.

effect in the CRI ranking. These countries generally have lower coping capacities as (financial) means are scarcer. Human mortality from extreme weather events has generally been found substantially higher in vulnerable countries (in 2010–2022, 15 times higher than low-vulnerability regions).[110]

The Human Development Index (HDI) further reinforces this analysis. The HDI looks into the three key dimensions of human development – long and healthy life (through a life expectancy index), being knowledgeable (through an education index), and decent standard of living (through a gross national income index) – and ranks countries on these factors.[111] The ranking aligns with the ND GAIN findings and CRI results, as it shows countries with 'low human development' mainly are from the Global South, especially African countries and some Asia-Pacific countries, which are among the countries most affected by extreme weather events.

Pakistan is one example, as the country's worst floods ever recorded were also why this was the most affected country in 2022, incurring nearly USD 15 billion in damage, with 1,700 fatalities and 8,168,000 people internally displaced.[112] This number does not include reconstruction costs, estimated at USD 16 billion. The number also does not include much-needed finance for supporting Pakistan's adaptation to climate change and overall resilience to future climate shocks.[113] Pakistan's flood impact assessment noted, 'the 2022 floods have shown Pakistan's high vulnerability to climate change despite contributing less than one percent of global greenhouse gas emissions'[114] The assessment also found the floods disproportionately impacted the poorest households in the poorest areas.

The floods' impact is likely to exacerbate existing gender inequalities, revealing serious disparities in safety, education, decision-making, and employment. More than 800,000 Afghan refugees currently live in calamity-hit areas in Pakistan. Women have suffered particularly notable losses to their livelihoods, especially those associated with agriculture and livestock, with associated negative impacts on their economic empowerment and wellbeing. The floods have increased women's vulnerability to gender-based violence due to aggravated household tensions, harassment, and abuse related to displacement and lack of secure infrastructure.

Looking ahead, the IPCC (2022) indicates (with high confidence) that future human vulnerability will continue to concentrate where capacities of local, municipal, and national governments, communities, and the private sector are least able to provide infrastructure and basic services.

3.3 Data gaps as a challenge to determining climate risks and impacts: A solution approach

A vast amount of data must be analysed in preparing an index; thus, data availability and quality are central in the index's quality. The data analysed for the CRI rely on scientific best practices and methodologies that are constantly evolving, with a view to ensuring the highest accuracy, completeness, and granularity. Several challenges arise regarding available data.

1. Data quality and coverage vary from country to country and within countries. This situation may incur geographical bias in EM-DAT resulting from unequal reporting quality and coverage across space.[115] There are particular data gaps for Global South countries, which might lead to these countries' misrepresentation in the CRI.[116] This issue is particularly pronounced for heat waves, also with a view to EM-DAT. Heat waves are not well recorded for Sub-Saharan Africa.[117] Extreme weather damage databases, such as EM-DAT, report no significant heat wave impacts in Sub-Saharan Africa since 1900, though the region has experienced several heat waves.[118] About 52% of heat wave events in EM-DAT occurred in nine countries: Ja-

110 IPCC 2022b.
111 UNDP 2024.
112 Internal Displacement Monitoring Centre 2024.
113 World Bank 2022.
114 Finance Division Government of Pakistan 2022.
115 EM-DAT Project 2022.
116 Dinku 2019.
117 Otto and Harrington 2020c.
118 Otto and Harrington 2020b.

pan, India, Pakistan, and the United States, followed by western European countries (France, Belgium, United Kingdom, Spain, and Germany).

The existence of data gaps is well known. The Sendai Framework, for example, aims to 'promote the collection, analysis, management and use of relevant data' and, particularly, includes mortality data improvement as a high priority.[119]

There are numerous reasons for data gaps, including the following:

a. Distribution of meteorological stations: Meteorological stations are distributed very unevenly worldwide, leading to significant data gaps for developing countries in particular (see, for example, UNDRR 2023b).[120] Meteorological stations provide a wealth of high-quality data for observing global meteorological changes. The stations are needed for registering extreme weather events. Zhan et al. (2023)[121] found that GDP and government spending were the main factors influencing the number of active stations in each country. The researchers also summarised that most meteorological stations are in developed countries. The WMO (2024) highlighted that, despite progress, there are still significant gaps in the coverage of observing networks, most notably in LDCs and SIDS, which are only collecting and internationally exchanging 9% of mandated Global Basic Observing Network data.[122] The large difference between Global South and Global North becomes clearer when looking at the number of weather stations in the United States, European Union, and Africa. While the United States and European Union (population: 1.1 billion) have 636 weather radar stations, the entire African continent (population: 1.2 billion) has 37 (Otto 2023). Otto (2023)[123] also concluded that, 'Floods are one of the deadliest natural disasters worldwide, but deaths linked with flooding aren't distributed evenly. They most often occur in places that lack weather data and warning systems — and most of those places are in the Global South.'

b. Insufficient systematic data collection and cataloguing: The data quantity and quality and the coverage of disaster events are insufficient in some areas.[124] For Global North countries, national governments provide numbers on fatalities, affected people, and economic losses. For Global South countries, however, this is often done by different non-governmental organisations that lack (sufficient) connection with meteorological services.[125] This shortcoming results in a severe lack of collated data that could accurately show losses. Systematic collection and cataloguing are needed for making information robust enough for planning and policymaking, especially for low-income, highly vulnerable countries and regions.[126],[127]

c. Use of different data collection techniques: Countries use different techniques to collect data on extreme weather events, and this might lead to distorted index results. For instance, some countries use 'excess mortality rate' to determine heat wave-related fatalities (in contrast to an [officially] recorded number of such deaths). This rate is expressed as a percentage of additional deaths in a month compared with a baseline period. The higher the value, the more additional deaths compared with the baseline.[128]

d. Under-representation of regions in research: Science clearly shows that research on climate change impacts is not evenly distributed worldwide. Campbell et al. (2018), focussing on heat wave and health impact research, found that 'regions most at risk from heat waves and health impact are under-represented in the research' (ibid). One reason for this outcome is that climate research is largely carried out by research institutes in Global North countries, resulting in a bias towards events in these countries.[129] Also, huge geo-

119 United Nations Office for Disaster Risk Reduction 2015.
120 United Nations Office for Disaster Risk Reduction 2023b.
121 Zhan et al. 2023.
122 World Meteorological Organization 2024b.
123 Otto 2023b.
124 Osuteye et al. 2017.
125 Otto and Harrington 2020c.
126 Otto and Harrington 2020b.
127 Ritchie and Rosado 2024.
128 eurostat 2020.
129 Otto and Harrington 2020c.

graphical differences exist in attribution science (see chapter 4).[130] Large attribution knowledge gaps are particularly found in Global South countries because of a lack of good weather data and well-evaluated climate models.[131] Therefore, current attribution studies 'provide very little information about those events and regions where the largest damages and socio-economic losses are incurred.'[132] Attribution studies, thus far, have focused on Europe (22%), eastern and southeast Asia (22%), and Northern America (19%), with only 1% covering northern Africa and western Asia.[133]

2. Methodological boundaries of data collection: Accurately attributing human loss to a particular extreme event faces certain methodological boundaries for data collectors (e.g. in determining whether the death of an older person during a heat wave resulted from the extreme temperature or from their advanced age).

To balance out the potential misrepresentation of Global South countries due to data gaps, a CRI sensitivity analysis including HDI as a correcting factor is used for missing data. As studies concluded that data gaps correlate with GDP and government spending,[134] the HDI is used as a proxy for data availability. However, this correlation still is not fully consistent across all assessed countries. There are instances, for example, of SIDS with high HDI rankings but that still exhibit significant data gaps. The HDI is a summary measure of average achievement in key human development dimensions: a long and healthy life, being knowledgeable, and having a decent standard of living. The HDI is the geometric mean of normalised indices for each of the three dimensions and represented by a value of 0–1. Countries are ranked in four groups: low (<0.55), medium (0.55–0.699), high (0.7–0.799), and very high (≥0.8).

For the CRI, the HDI is incorporated as a proxy for data availability. First, the 'HDI gap' is determined for each country, illustrating the gap between a country's HDI score and the 'perfect' HDI score of 1. The result is weighted and added to a country's CRI score as an 'HDI correction.' So as not to overcorrect the factual data calculations in the CRI, a conservative weighting of 10% is used for the correction. Additionally, countries with a very high HDI score (≥0.8) are excluded under the assumption that data gaps are less likely within them.

Accordingly, the 'HDI-corrected' CRI score can be written as:

$$\textbf{CRI score}_{\textbf{HDI-corrected}} = \textbf{CRI score x 0.9 + 'HDI gap' x 0.1}$$

Figure 9 shows the HDI-corrected CRI ranking for 1993–2022. There are now nine developing countries (compared with seven in the uncorrected ranking) among the 10 most affected. Honduras, Vanuatu, the Philippines, and Haiti move up in the ranking because of the HDI correction. Italy, because of the very high fatalities resulting from the 2022 heat wave, still ranks in the uppermost 10, while all other developed countries move out of this group (including Greece and Spain). The HDI correction's significance is also clearly visible with a view to the 20 most affected countries in 1993–2022. Developing countries now account for 17 of 20 (compared with 12 of 20 for the uncorrected ranking).

130 Clarke et al. 2022.
131 Friederike et al. 2020a.
132 ibid.
133 McSweeney and Tandon 2024.
134 Zhan 2023.

Figure 9: 20 countries most affected in 1993–2022 (HDI-corrected)

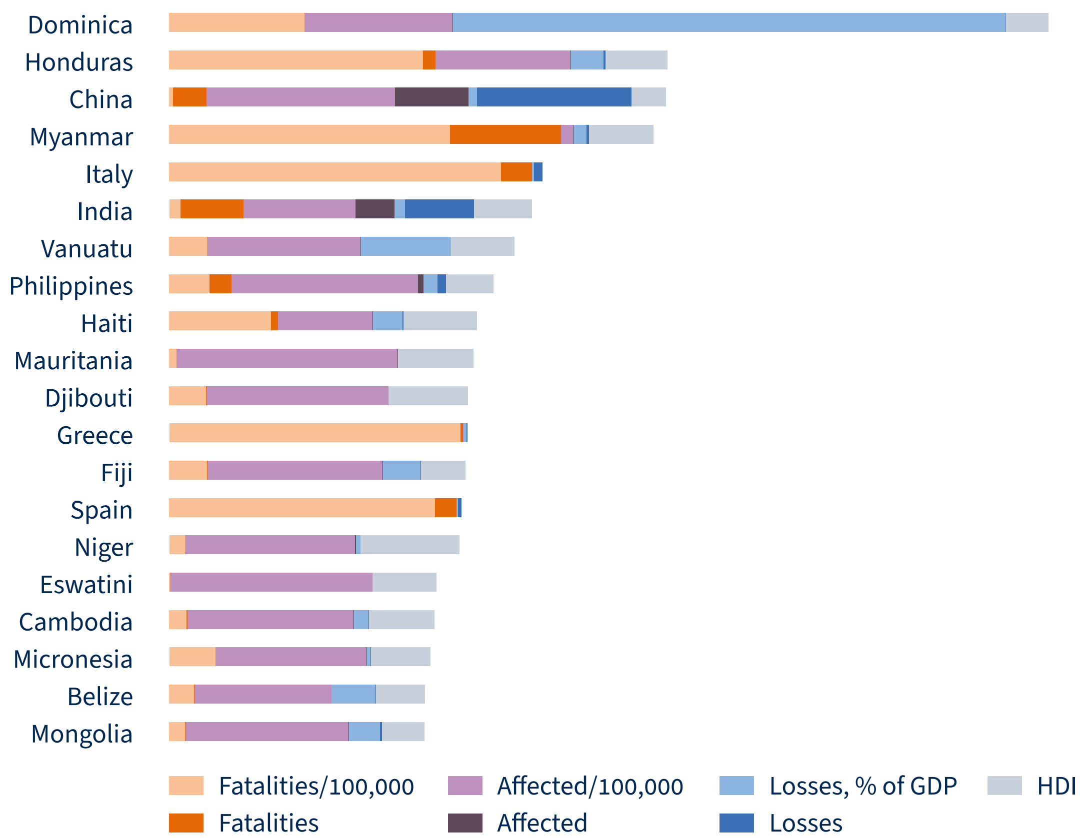
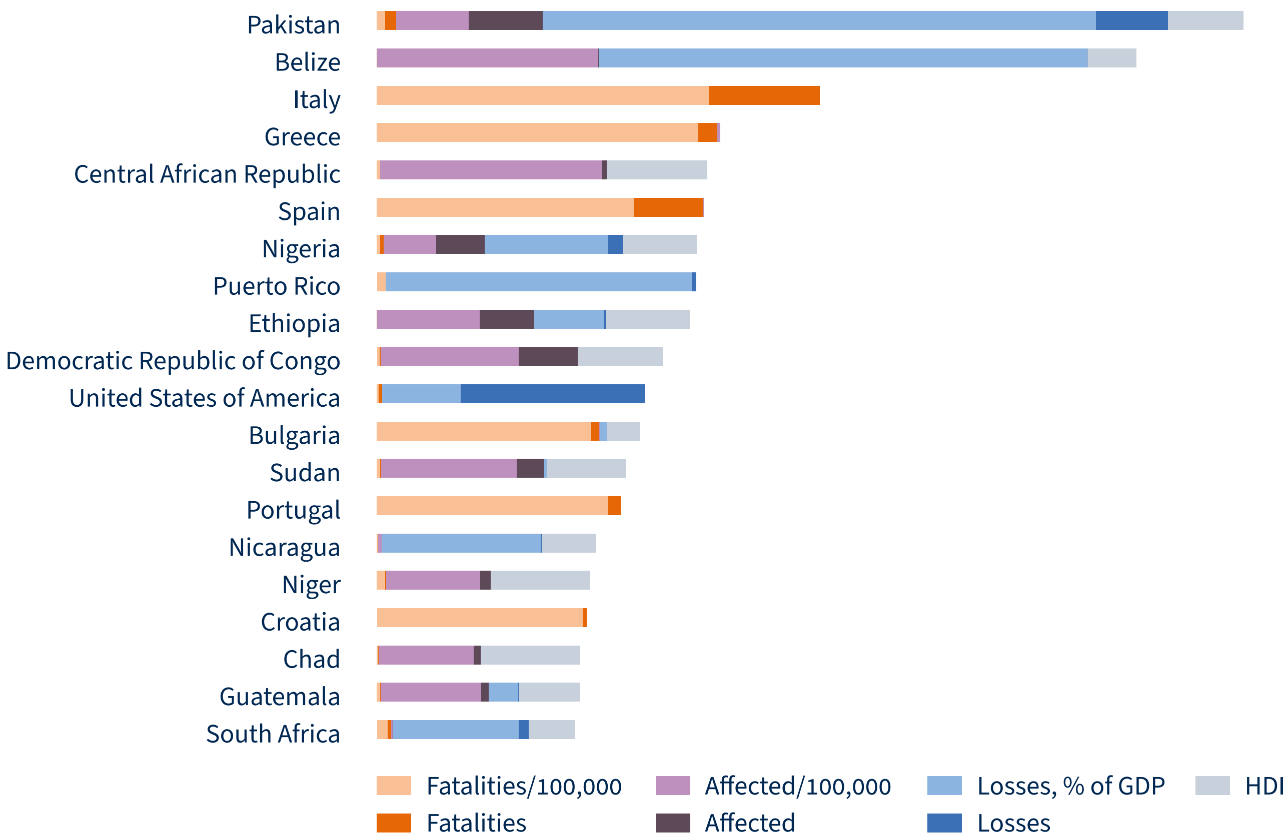


Figure 10 shows the HDI-corrected CRI ranking for 2022. There are now seven developing countries (compared with only four in the uncorrected ranking) among the 10 most affected. Developing countries, such as the Central African Republic, Nigeria, and the Democratic Republic of Congo, rise in the ranks, while developed countries, such as the United States, move out of the uppermost 10. The HDI correction's significance is also clearly visible with a view to the 20 most affected countries in 1993–2022. Developing countries now account for 13 of 20 (compared with 10 of 20 for the uncorrected ranking).

Figure 10: 20 countries most affected in 2022 (HDI-corrected)



4 Linking extreme weather events and climate change

Extreme weather events' emergence and formation are complex. Many interrelated factors must be considered in explaining the specific causes. However, science clearly demonstrates climate change's significant effect on certain types of events' frequency, intensity, and duration. Understanding this relationship is essential for mitigating risks and preparing to deal with impacts. This chapter first presents the current scientific status of attribution of extreme weather events to climate change and then details climate change's effects on the most important hazard types for the CRI.

4.1 Current scientific status of attribution science

Science has thoroughly researched the connection between extreme weather events and climate change. The IPCC Sixth Assessment Report states with high confidence that, 'Human-caused climate change is already affecting many weather and climate extremes in every region across the globe. This has led to widespread adverse impacts and related losses and damages to nature and people.'[135]

Above all, attribution science has built a solid evidence base on human-induced climate change's contribution to individual extreme weather events. By comparing real-world data with a simulated climate that excludes certain factors, such as greenhouse gas emissions (e.g. simulating a world without climate change), attribution science estimates climate change's influence on extreme weather events.[136] Attribution science, which emerged in the 1990s, has evolved from a new, seldom-applied method struggling to pinpoint causes of individual events to a multimethod approach with more than 600 studies on more than 750 events to date.[137] Across all 750 cases, 74% were made more likely or severe because of climate change, according to a meta-analysis by Carbon Brief.[138] Studies now can answer whether and to what extent human-induced climate change affected extreme weather events' likelihood, intensity, or impact.[139] The IPCC Sixth Assessment Report, therefore, notes that, 'Evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclones, and, in particular, their attribution to human influence, has strengthened since AR5.'[140] Even rapid attribution following single events is possible.[141]

135 IPCC 2023.
136 Otto 2017.
137 McSweeney and Tandon 2024.
138 Ibid.
139 Otto 2023a.
140 IPCC 2022.
141 Taminga et al. 2025.

However, huge geographical differences exist in attribution studies, similar to general climate change data (see chapter 4).[142] Large attribution knowledge gaps are especially present for Global South countries because of a lack of adequate weather data and well-evaluated climate models.[143] Therefore, current attribution studies ‘provide very little information about those events and regions where the largest damages and socio-economic losses are incurred.’[144] Such studies, thus far, have focused on Europe (22%), eastern and southeast Asia (22%), and Northern America (19%), with only 1% covering northern Africa and western Asia.[145]

4.2 Attribution of CRI event types to climate change

Heat waves

‘Heat wave’ refers to a period of abnormally hot and/or unusually humid weather, lasting from two days to weeks.[146] Countries and regions apply different thresholds for temperature and duration in defining an event as a heat wave.[147] As heat waves are primarily influenced by thermodynamic factors, it is easier for attribution scientists to establish a causal link to climate change compared to other extreme weather events.[148] This fact has led to heat waves being studied more extensively than other extreme weather events. Extreme heat events appear to be growing more frequent because of climate change, and heat levels once considered very rare are now merely seen as unusual.[149] According to the IPCC Sixth Assessment Report, heat waves that had a 10% chance of occurring annually in the pre-industrial climate are now 2.8 times more frequent and 1.2°C hotter.[150] If 2°C of global warming is surpassed, the frequency will rise to 5.6 times, with 2.6°C temperature increases.[151]

For 2022, attribution studies found that human-caused climate change made the heat wave event in parts of western Europe at least 10 times more likely.[152] Climate change also made devastating early heat in India and Pakistan 30 times more likely.[153]

Heat waves negatively impact the health of affected people. The increased frequency and intensity of heat waves is followed by heat-related illnesses. Moreover, heat-related mortality has increased, with one study attributing 37% of heat-related deaths globally to climate change.[154] Rising temperatures disproportionately affect the most vulnerable groups in society – older people, children, and people with pre-existing medical conditions.[155] Additionally, a large part of the global population resides in hotter regions, where heat waves’ impacts are felt most acutely.

The data gaps in climate and attribution science for Global South countries (see chapter 4) are particularly pronounced regarding heat waves, including EM-DAT, which the CRI uses. Heat waves are, for instance, not well-recorded for Sub-Saharan Africa.[156] Extreme weather damage databases, such as EM-DAT, report no significant heat wave impacts in Sub-Saharan Africa since 1900, though the region has experienced several heat waves.[157] About 52% of heat wave events recorded in EM-DAT occurred in nine countries: Japan, India, Pakistan, United States, followed by western European countries (France, Belgium, United Kingdom, Spain, and Germany).

Floods

‘Flood’ is a general term for water overflow from a stream channel onto normally dry land in the floodplain (riverine flooding), higher than normal levels

142 Clarke et al. 2022.
143 Otto 2023a.
144 Ibid.
145 McSweeney and Tandon 2024.
146 Centre for Research on the Epidemiology of Disasters 2024.
147 Copernicus 2024a.
148 Tandon 2024.
149 Clarke et al. 2022.
150 IPCC 2022b.
151 Clarke et al. 2022.
152 World Weather Attribution 2022c.
153 World Weather Attribution 2022a.
154 Vicedo-Cabrera 2021.
155 Clarke et al. 2022.
156 Otto and Harrington 2020c.
157 Otto and Harrington 2020b.

along the coast and in lakes or reservoirs (coastal flooding), and ponding of water at or near where the rain fell; i.e., flash floods.[158] A 'flash flood' is heavy or excessive rainfall in a short period of time and that produces immediate runoff, creating flood conditions within minutes or a few hours during or after the rainfall.[159]

Attribution science faces multiple challenges in analysing flood events. Scussolini et al. (2023) indicated a non-linear relationship between rainfall and flood occurrence or severity, as the relationship depends on various factors, such as hydrological processes, river and coastal management, and pre-existing conditions before rainfall. Human interventions, such as dam construction and land-use changes (e.g. agricultural development), also can influence flood dynamics by amplifying, mitigating, or outweighing climate change's effects.[160] Despite these complexities, the principal findings show heavy rainfall has become more frequent and intense in many parts of the world because of climate change.[161] The aggregated findings in the latest IPCC report indicate that, at a global scale, a rainfall event that would be expected once in 10 years now has a 1.3-times chance of occurring every 10 years and will bring greater precipitation.[162] This frequency is expected to increase as global warming continues.[163]

The global temperature increase leads to rising global sea levels, which increase coastal flooding.[164] Additionally, the higher GHG emissions level leads to more tropical cyclones, which often cause floods.[165] Scientists also have found, with a high level of confidence, that increased precipitation extremes and inland flooding can be attributed to global surface air temperature warming.[166]

Scientists have observed that annual monsoons in parts of Asia and Africa are changing because of climate change. Shorter but more intense rains are having negative impacts in many low- and middle-income countries, where large populations depend on monsoons for agriculture.[167] Hurricane Katrina was one event where attribution scientists could establish a clear link between a flood event and climate change. The hurricane struck the US southeastern coast in 2005, killing 1,800 and causing widespread destruction. Simulating sea level and climate conditions from 1900, Irish et al. (2013) unpacked climate change's influence on this event. Their findings suggest that 'flood elevations during Hurricane Katrina […] were estimated to be 15 to 60% higher in coastal areas' because of sea level rise. Thus, while attribution science should account for different factors when examining floods, the general trend is that increased rainfall and sea level rise are already leading to more severe flooding in different parts of the world.

Drought

A drought is an extended period of unusually low precipitation, which brings a water shortage for people, animals, and plants.[168] Drought differs from most other hazards in that it develops slowly, sometimes even over years, and its onset is generally difficult to detect. The IPCC's latest report outlines various types of drought, including meteorological (precipitation deficits), agricultural (soil moisture deficits), ecological (plant water stress), and hydrological (shortages in reservoirs, lakes, and groundwater). All types of drought are interconnected, essentially describing a moisture shortage in different parts of the hydrological system.[169] Higher temperatures and precipitation deficits, either individually or together, are key drivers of drought. Attribution scientists face challenges in GHG emissions' indirect influence on precipitation and, in turn, on drought.[170]

158 Centre for Research on the Epidemiology of Disasters 2024.
159 Ibid.
160 Scussolini et al. 2024.
161 Fischer 2021.
162 IPCC 2022.
163 Clarke et al. 2022.
164 IPCC 2022.
165 Irish et al. 2014.
166 Tebaldi et al. 2023.
167 Katzenberger et al. 2021.
168 Centre for Research on the Epidemiology of Disasters 2024.
169 McSweeney 2021.
170 Olsen et al. 2023.

The IPCC Sixth Assessment Report stated with medium confidence that 'human-induced climate change has contributed to increases in agricultural and ecological droughts in some regions.'[171] The report warns, with high confidence, that agricultural and ecological drought will continue to increase. Drought has severe impacts on people and ecosystems, leading to lower water quality, harm to aquatic ecosystems, crop failure, livestock losses, and reduced water availability. This is particularly detrimental to the agricultural sector, contributing to food insecurity, which can drive human conflicts and displacement.[172] For instance, in the Horn of Africa, a severe drought since October 2020 has led to acute food insecurity for millions of people. Attribution scientists have shown that the conditions would not have led to such a drought in a 1.2°C-cooler world.[173]

Regarding 2022, attribution studies have found that, for the Northern Hemisphere extratropics, human-induced climate change made the observed soil moisture drought much more likely, by a factor of ≥20 for root zone soil moisture and ≥5 for surface soil moisture.[174]

Storms and tropical cyclones

The CRI includes several types of storms, with tropical cyclones being the most destructive. A tropical cyclone originates over tropical or subtropical waters.[175] It is characterised by a warm-core, non-frontal synoptic-scale cyclone with a low pressure centre, spiral rain bands, and strong winds. Depending on their location, tropical cyclones are also referred to as 'hurricanes' (Atlantic, Northeast Pacific), 'typhoons' (Northwest Pacific), and 'cyclones' (South Pacific and Indian Ocean). While these storms' wind speed thresholds vary by region, the Saffir-Simpson Hurricane Wind Scale is a commonly used classification system. This scale categorises hurricanes into five levels based on their sustained wind speeds, from 1 (minimal damage) to 5 (catastrophic damage). The scale helps estimate storms' potential destruction and impact.

Climate change's influence on tropical cyclones is more complex than for other types of extreme weather events, as heavy rainfall and extreme winds drive the impacts.[176] Moreover, the surrounding conditions, such as sea surface temperatures, are vital for storm formation. Warmer ocean temperatures, driven by climate change, act like fuel for tropical cyclones, intensifying the strength of these storms and, thus, potentially making them more destructive.[177] Additionally, as warmer air holds more moisture, these storms are likely to lead to heavier rainfall in affected regions.[178] The IPCC Sixth Assessment Report found, 'it is likely that the global proportion of category 3-5 tropical cyclone instances and the frequency of rapid intensification events have both increased globally over the past 40 years.'[179]

Attribution science findings show that climate change is strengthening conditions conducive to the most powerful hurricanes, with more intense rainfall totals and wind speeds.[180] Studies have repeatedly shown that recent extreme flood events can be attributed to climate change. The causes of these events include Superstorm Sandy[181] (2012 in the Caribbean and the eastern United States) and Hurricane Katrina (2005 in Louisiana).[182] Attribution science also found that climate change was a key driver for the catastrophic impacts of Hurricane Helene in the United States in 2024.[183]

Wildfires

Wildfires are uncontrolled and unpredictable combustion or burning of plants in a natural setting, such as forest, grassland, brush land, or tundra, and that consume the natural fuels and spread depending on

171 IPCC 2023.
172 World Weather Attribution 2023.
173 Ibid.
174 World Weather Attribution 2022b.
175 Centre for Research on the Epidemiology of Disasters 2024.
176 World Weather Attribution 2024a.
177 IPCC 2019.
178 Ibid.
179 IPCC 2022.
180 World Weather Attribution 2024a.
181 Sweet et al. 2013.
182 Irish et al. 2014.
183 World Weather Attribution 2024a.

environmental conditions (e.g. wind, topography).[184] Wildfires are driven by factors such as high temperature, low humidity, lack of rain, fuel availability, and high wind speed.[185] While they can cause direct loss of human lives, their death toll tends to be lower than for other weather extremes.[186] However, inhaling wildfire smoke can lead to long-term respiratory health issues and wildfires are also associated with large losses of wildlife and other parts of the ecosystem. Wildfires are complex to study, as their occurrence depends on pre-existing weather conditions (such as drought) and whether vegetation was subjected to low humidity and rainfall.[187] As such, they are closely linked to other extreme weather events, such as drought and heat waves. Carbon Brief indicates wildfires are one of least-studied weather extremes in the context of attribution science.[188]

The devastating bushfires in Australia in 2019/2020, with up to 19 million hectares burnt, are a prime example.[189] The wildfires were fuelled, in part, by the prolonged drought that preceded them. Van Oldenborgh et al. (2020) found that climate change made the event 30% more likely,[190] and concluded that increasing temperatures bring a higher risk of such extreme fire seasons.[191] Similarly, Du et al. (2021) found that human-induced climate change was a driving force of the spring 2019 wildfires in southwest China.[192] Researchers also identified a 'significant anthropogenic contribution to the risk of extreme fire weather' in Canada's unusually intense wildfire season of 2017.[193] Overall, wildfires' intensity and occurrence can be clearly linked to climate change, though further studies are needed.

184 Centre for Research on the Epidemiology of Disasters 2024.
185 Dowdy et al. 2009.
186 Clarke et al. 2022.
187 Van Oldenborgh et al. 2021.
188 McSweeney and Tandon 2024.
189 WWF 2018.
190 Van Oldenborgh et al. 2021.
191 Ibid.
192 Wang et al. 2019.
193 Kirchmeier- Young et al. 2019.

5
CRI context: Status quo of international climate and resilience policy

"Climate catastrophe is hammering health, widening inequalities, harming sustainable development, and rocking the foundations of peace. The vulnerable are hardest hit."
UN Secretary-General António Guterres[194]

The CRI 2025 clearly shows that extreme weather events' impacts are being felt worldwide as increasing climate change further exacerbates the situation. Over the 30-year span of 1993–2022, the index shows that Global South countries were particularly affected. Five of the 10 most affected countries were in the lower middle-income group of developing countries, with three LDCs or SIDS. These countries, and especially the population's most vulnerable parts, are particularly affected by hazards' damaging effects (as, for example, their livelihoods depend on fewer assets) and have a lower coping capacity (e.g. they cannot rely on savings to buffer the impacts and may need longer to rebuild and recover). In 2022, particularly high-income countries ranked very high in the index and were heavily affected by the impacts, while having better coping capacity to rebuild in the aftermath of a disaster. However, the most vulnerable groups (e.g. older people and children) were especially affected and risk management needed improving in those countries.

The year 2024 was marked by international crisis and strong geopolitical tensions, exerting pressure on the multilateral system. In this year of a high number of elections (over half the world's population in 72 countries were eligible to vote), the conflict between an often fossil-focussed authoritarian, radical right-wing camp and an increasingly fragmented more liberal camp dominated. In many countries, parties that want less international cooperation and an extension of the fossil fuel business model won. The collective outcome of these results will also have consequences for supporting the most vulnerable countries in dealing with climate change's consequences. This impact was already evident at COP29, which concluded with a new climate target that fell far short of the countries' needs. Meanwhile, records have been broken. After exceptionally high average monthly temperatures, 2024 was the hottest year on record[195] and the first full year at more than 1.5°C above pre-industrial temperatures, while extraordinary unprecedented extreme weather events have occurred worldwide.

194 World Meteorological Organization 2024b.
195 World Meteorological Organization 2024c.

Already today, around 3.3–3.6 billion people live in climate change-vulnerable conditions,[196] and extreme weather events have already led to irreversible impacts, adaptation limits have been reached and impacts materialised in economic and non-economic L&D. The impacts disproportionately affect the most vulnerable, with LDCs, Least Developed Land-Locked Countries (LLDCs), and SIDS suffering a higher share of fatalities due to disasters.[197] Increased human mobility and displacement are another consequence of those impacts, with SIDS being extremely affected (IPCC 2022). In 2023 alone, worldwide, 26.4 million more people were internally displaced because of disasters.[198] Assessments show that costs of around USD 143 billion due to extreme weather events are attributable to climate change.[199]

5.1 The large emissions gap

Responsibility for the further-increasing climate crisis lies in GHG emissions, which impact global mean temperature changes, and the resulting intensification of slow- and rapid-onset processes and events and their related impacts. Countries' **mitigation actions** are failing dramatically and, thus, failing in implementing the Paris Agreement goals. Global GHG emissions, rather than decreasing, rose by 1.3% from 2022 to 2023, according to the latest emissions gap report.[200] While a global emissions peak is expected soon,[201] without higher ambition, including in nationally determined contributions (NDCs), the world is on track for a temperature increase of 2.6–3.1°C by 2100. Staying below 1.5°C is technically still possible but it will require exceptional efforts,[202] needing roughly a halving of emissions by 2030. Countries vary widely in their emissions and emissions trends. Variation is also significant regarding different income levels. At the global level, the 10% of the population with the highest income accounted for 48% of emissions in 2022 (with two-thirds living in developed countries), whereas the bottom 50% of the world population (with the lowest income) accounted for 12% of emissions.[203] Extreme weather events are heavily and increasingly affecting all countries, and the 2022 ranking shows seven high-income countries among the 10 most affected. Substantially increasing mitigation action is also in those countries' self-interest. This is also true as global crises, such as supply chain interruptions and higher food prices, affect them as well.

5.2 Status quo of international resilience building efforts

At the same time, investment in countries' overall resilience is more important than ever. Efforts to achieve the 2015-adopted **Sustainable Development Goals (SDGs),** focussing on key global challenges, including the climate crisis, remain insufficient. Even as some countries are progressing, none of the 17 SDGs will be achieved by the intended 2030, according to an SDG status report.[204] Implementation of SDG 13 ('Take urgent action to combat climate change and its impacts') faces especially large challenges and progress is stagnating.[205] Climate change, including extreme weather events' increasing frequency and intensity, is itself a hurdle for SDG achievement, such as in reduced food and water security.[206] At the same time, the pace of SDG progress varies widely across country groups. Nordic countries lead in SDG achievement and BRICS countries are making substantial progress, while poor and vulnerable nations (those most existentially affected also by climate impacts) lag far behind.[207] The gap between the world average SDG Index score and that of poor countries and SIDS, in fact, widened in 2023 compared with 2015. The COVID-19 crisis and its impacts were identified as the main reason for this gap.[208] This scenario shows the importance of countries' resilience for buffering external shocks and shocks such as ex-

196 IPCC 2023.
197 UNDRR and WMO 2024.
198 Internal Displacement Monitoring Centre 2024.
199 Newmann and Noy 2023.
200 UNEP 2024a.
201 DNV 2024.
202 UNEP 2024a.
203 UNEP 2023a.
204 Sachs et al. 2024.
205 Ibid.
206 IPCC 2022b.
207 Sachs et al. 2024.
208 Ibid.

treme weather events, and their impacts, and the importance of increasing support for the most vulnerable countries. However, this support is lacking.

Throughout 2023, nearly 30 million more people needed **humanitarian assistance.** Only one-third of the required USD 57 billion for this assistance was received, according to the United Nations Office for Humanitarian Assistance (UNOCHA). It was also the first year since 2010 when funding declined from the previous year, while humanitarian assistance needs are expected to increase with the climate crisis as one of the three key drivers of this development.[209]

In terms of effective **resilience and risk management governance and approaches,** the implementation of the **Sendai Framework** (2015-2030) by the United Nations Office of Disaster Risk Reduction (UNDRR) is especially important. Countries generally have made progress in implementing the Sendai Framework with its seven global targets, but the progress has been uneven and varies across the targets. Notable achievements include the near-halving of global disaster mortality per 100,000 people, more than doubling of the number of countries with national strategies for disaster risk reduction, local governments in 108 countries having risk-reduction strategies, and the improved global coverage of multi-hazard early warning systems. At the same time, two-thirds more people were affected by disaster impacts, economic loss owing to disasters is still high and expected to further increase, disasters have disrupted basic services (e.g. education and health services), and international support for vulnerable countries in the Global South remains insufficient. Those most affected – such as SIDS, LLDCs, and LDCs – also still face severe challenges with data, statistical and technological capacity, disaster risk governance, and comprehensive risk management. This situation continues to hinder their progress.[210]

The implementation of **Multi Hazard Early Warning Systems** (MHEWS) is an important part of the Sendai Framework and supported by the UN Secretary General's **EWS4All-Initiative.** As of May 2024, fortunately, over half of the countries (55%) have MHEWS in place. Coverage of SIDS is at two-thirds, while, unfortunately, under half of all LDCs and LLDCs have MHEWS in place. While progress has been made and the situation is generally improving, the lack of risk knowledge still hampers the effectiveness of MHEWS.[211]

Country examples clearly show that effective climate change adaptation and disaster risk management strategies are reducing risks and impacts. In Bangladesh, risk prevention and adaptation significantly improved and led to a huge decline in cyclone-related mortality, from roughly 500,000 fatalities in 1970 to just 4,234 in 2007.[212]

Efforts to improve adaptation to those impacts are another factor in strengthening countries' resilience to the climate crisis' impacts. A key instrument in this regard is **National Adaptation Plans (NAPs),** which aim to identify countries' adaptation needs and provide strategies to respond to those needs. As of November 2024, 62 countries had formulated and submitted an NAP to the UNFCCC secretariat (15 LLDCs, 13 SIDS, and 22 LDCs).[213],[214] Apart from Pakistan, which only submitted a NAP in mid-2023 (even after the heavy flooding in 2022), none of the 10 most affected countries in 2022 had submitted one. Of the 10 most affected countries in the 30-year span, only the Philippines had submitted an NAP and that was only in 2024.[215] More broadly, 171 countries have at least one national adaptation planning instrument (policy, strategy, or plan) in place.[216] Importantly, while the increased number of NAPs is a positive and vital development, implementing these NAPs is what will eventually make a difference in resilience-building, which, for now, is greatly lacking.

The **Global Goal on Adaptation (GGA)** established under the Paris Agreement and with a structure agreed upon at COP27 is another critical piece for global resilience-building. Two key priorities shaped negotia-

209 UNOCHA 2023.
210 UNGA 2024.
211 UNDRR and WMO 2024.
212 Haque et al. 2012.
213 United Nations Climate Change 2024.
214 UNFCCC 2024a.
215 UNFCCC 2024c.
216 UNEP 2024.

tions at COP29 in Baku: (1) Addressing whether and how means of implementation (finance, technology, and capacity) would be integrated into the GGA framework and (2) charting a clear roadmap for developing adaptation indicators to measure global adaptation progress. The technical phase advanced indicator refinement but the political phase saw diluted language on means of implementation and little progress in transformational adaptation. Outcomes included agreements to develop quantitative and qualitative indicators, including for means of implementation and the launch of the Baku Adaptation Roadmap to support GGA implementation. While GGA foundational elements are starting to take shape, there are still no actionable strategies for real-world impact. Evidence shows the value of adaptation; for example, a USD 16 billion annual investment in agriculture could prevent about 78 million people from starving or chronic hunger due to climate change impacts.[217] Similarly, a USD 1 billion investment in coastal flood adaptation yields a USD 14 billion reduction in damage. Ambitious adaptation can cut global climate risk by half under all warming scenarios,[218] but global adaptation finance flows are extremely low. The Adaptation Fund (AF), for instance, which is one of the few mechanisms delivering high-quality, grant-based, community-focused finance through direct access instruments to developing countries, is chronically underfunded. Contributions to the AF totalled USD 130 million in 2024, less than half of its USD 300 million annual funding target, which itself was a compromise figure. Inadequate and unpredictable resources for the AF have limited its ability to significantly scale up its adaptation actions.

5.3 Dire outlooks for resilience finance: Countries urgently need to increase finance for the most vulnerable

The year 2024 was a decisive one for **international climate finance.** After three years of discussions, technical expert dialogues, and exchange of expertise, the **New Climate Finance Goal (NCQG)** for post-2025, as agreed to in Paris 2015, was decided at COP29 in Baku, Azerbaijan. Meanwhile, the current annual goal of USD 100 billion was achieved for the first time in 2022. Two years after the target year, developed countries provided and mobilised USD 115.9 billion in climate finance for developing countries.[219] The amount of public finance was increased to 80%. But only 32% of this public finance went to **adaptation finance,**[220] failing to achieve the 50% targeted for a fair balance between mitigation and adaptation finance. While public adaptation finance for developing countries could be increased from USD 22 billion in 2021 to USD 28 billion in 2022, the gap between estimated adaptation needs (USD 215–387 billion annually) (UNEP 2024b) remains appalling. In fact, 87–93% of needs are not being financed. Even more troubling is that just 28% of total climate finance was provided as grants, with the majority in the form of loans.[221] Alarmingly, not all these loans were even concessional, as some were extended on market terms, further straining the recipient countries' fiscal capacities.[222] While many Global South countries are already highly in debt, this is particularly problematic, as instruments such as loans, especially for adaptation and L&D finance/measures, are further exacerbating the situation.

COP29 decided on an **NCQG** and this has been perceived as a great disappointment, especially by most vulnerable countries. It targets mobilising ≥USD 300 billion annually by 2035 for developing countries to mitigate and adapt to the climate crisis, without clear thematic subgoals or floors. A linear increase would mean an annual increase of USD 20 billion. The decision includes the request that developed countries 'take the lead' (with no clear definition of what this refers to), while developing countries are encouraged to contribute voluntarily. As the related decision[223] recognised that ≥USD 1.3 trillion annually would be needed, it demonstrates the gap between the new goal and countries' actual needs and, thus, the target's insufficiency. The Baku to Belém Roadmap, to be agreed on

217 Sulser et al. 2021.
218 Magnan et al. 2021.
219 OECD 2024.
220 Ibid.
221 Ibid.
222 18% of bilateral finance were non-concessional loans, 59% non-concessional loans from climate funds, and 73% non-concessional loans from MDBs, OECD 2024.
223 UNFCCC 2024b.

in 2025, aims to increase the mobilisation of finance from public and private sources to USD 1.3 trillion annually by 2035 and will reduce this gap. The result will be vital for COP30 in 2025.

The situation worsens when looking into the outcome for strengthening resilience. The conference failed to include **L&D** as part of the new finance goal and, thus, does not specify the necessary obligations for developed countries to provide finance, while vulnerable developing countries are forced to further bear the brunt of the costs. The **Fund for Responding to Loss and Damage (FRLD),** as part of the UNFCCC Financial Mechanism, is explicitly mentioned in the decision and potentially can channel finance. However, the thematic area of L&D as a whole is not included in the goal formulation, so it is at most a highly indirect inclusion.

L&D has not been included even in the current climate finance goal of USD 100 billion annually. The picture is even bleaker when considering the needs estimated for dealing with L&D. There are no officially accepted L&D finance need estimates and existing estimates vary widely. Such estimations are difficult. Needs heavily depend, for example, on the scale of mitigation and adaptation action and the magnitude by which extreme weather events intensify. Calculations thus far merely follow a top-down, rather than a more precise sector-to-sector, approach. Markandya/González-Eguino (2018) calculated a widely accepted estimate of around USD 290–580 billion of residual damage annually by 2030 for developing countries.

Though pledges have been made towards the newly established FRLD, few countries have announced a contribution and the overall volume of pledges (around USD 56 million USD) is very low compared with the needs . Pledges since COP28 in 2023 are an important signal but still only account for around USD 750 million and, thus, are far from what is necessary. Also, without explicit inclusion of L&D in the NCQG, the necessary traction for increasing this sum must come through other processes and initiatives. There is a high risk of undermining the successes of past COPs if the FRLD, which should be ready for disbursement from 2025, remains inadequately equipped. There is a critical need to establish innovative finance instruments, based on the polluter pays principle and whose revenues would be used for L&D finance/for measures to address L&D. Fossil fuel companies have privatised their profits of USD 3.5 billion daily during the last 50 years and they should now also bear the external costs of their actions.

Looking ahead, the FRLD needs a reliable funding strategy if it is to remain relevant and capable of delivering on its mandate of 'assisting developing countries that are particularly vulnerable to the adverse effects of climate change.'[224] COP30 in Bélem should approve such a strategy to be developed by the FRLD Board. Also, as not finalised in Baku at COP29, the 3rd Review of the Warsaw International Mechanism for Loss and Damage will be further discussed at SB62 in Bonn 2025. One key demand Global South countries raise in this regard is establishing an L&D Gap Report, comparable with the UNEP adaptation and mitigation gap reports.

While actors have already been taking the legal avenue[225] to push for support for the most vulnerable countries because of slow progress at the international policy level, at the end of 2024, a landmark process started for **climate litigation.** The **International Court of Justice (ICJ)** is moving towards issuing an advisory opinion, which will clarify states' legal obligations regarding climate change under international law, and the consequences for breaching them.[226] Highly affected SIDS (the foremost being Vanuatu, ranked 9th in the long-term CRI) took the lead in pushing the UN General Assembly (UNGA) to request that the ICJ formulate this advisory opinion. This will not be legally binding, though it will send a powerful signal to justice and policy systems around the world, as results are expected for 2025.

5.4 The climate–security nexus

Climate change impacts are a fundamental challenge for people's wellbeing and countries' integrity. The climate–security nexus largely depends on the social, economic, and natural circumstances in which the fac-

224 UNFCCC 2022.
225 UNEP Nairobi 2023b.
226 International Court of Justice 2024.

tors unfold and can be understood as a threat multiplier[227] towards peace and security. Burke et al. (2024) discussed potential mechanisms through which climate (change) affects conflict; they encompass economic conditions, socio-demographic factors, migration, politics, and psychological mechanisms.[228] Despite growing scientific knowledge of these interlinkages, climate extremes' exact mechanisms in social conflicts remain unclear.[229] In states with tension between different ethnic groups, where exclusion, discrimination, and polarisation exist, groups are particularly susceptible to developing conflict following an extreme event. For example, heavily agriculture-dependent and marginalised groups in Asian and African countries face increased risks of conflicts due to increased drought.[230]

Regarding the integrity of lives and livelihoods and, thus, human security, Adger et al. (2014) found that **'climate change is an important factor threatening human security** [see definition below] through undermining livelihoods, compromising culture and identity, increasing migration that people would rather have avoided and challenging the ability of states to provide the conditions necessary for human security.'[231]

In not only examining traditional concepts of security that foremost aim to protect states, the concept of **human security** addresses 'widespread and cross-cutting challenges to survival, livelihood and dignity of people.'[232] The concept advances comprehensive responses that address complex challenges' multidimensional causes and consequences. It combines aspects of human rights, human development, peacekeeping, and conflict prevention, and one dimension of the concept is already closely linked to further development of the UN human rights system regarding climate change. The appointment of the first **UN Special Rapporteur on the promotion and protection of human rights in the context of climate change** in 2022 was a milestone. The connection between climate change impacts and human security already was identified in 1994 in the UN Development Programme (UNDP) Human Development Report.[233]

At the UN level, the UN Department of Political and Peacebuilding Affairs, UNDP, UNEP, and UN Department of Peace Operations joined forces and initiated the **Climate Security Mechanism.** This aims to better understand and address linkages between climate change, peace, and security.[234]

The climate–security nexus also has found its way into the **UN Security Council,** which holds the primary responsibility for maintaining international peace and security. After first being discussed in 2007 in an attempt to address the issue by the United Kingdom, the understanding of climate impacts' security implications has increased substantially and a full body of research has been conducted on the topic.[235] Steps, such as the formulation of related resolutions, were also taken within the Security Council.

In 2018, the **Group of Friends of Climate and Security** was founded on the initiative of Nauru and Germany. Since then, the issue has been on the agenda, also with specific focus on climate change impacts, such as in January 2019, with a Dominican Republic-led debate on, 'Addressing the impacts of climate-related disasters on international peace and security.' The Group's demands aim to more systematically strengthen awareness of climate-induced security implications, such as through a regular comprehensive United Nations Secretary-General report on the peace and security implications of climate change's adverse effects in country- or region-specific contexts.

227 Schleussner et al. 2016.
228 Burke et al. 2024.
229 Vinke 2023.
230 von Uexkull et al. 2016.
231 Adger et. al 2014.
232 United Nations General Assembly 2012.
233 UNDP 1994.
234 UN 2024.
235 Burke et al. 2024.

6 Method

6.1 Objectives and scope

The CRI analyses climate-related extreme weather events' economic and human effects on countries and, thereby, measures the realised risks' consequences for countries. The index ranks countries according to their economic and human effect, with the most affected country ranked first. Climate science and significantly improved attribution science clearly show that climate change is affecting the intensity, frequency, and duration of many extreme weather events. Also, extreme weather events' impacts on, for example, economic costs and human health are more clearly attributable to climate change.[236]

The results and a high rank in the CRI should be understood as a warning signal for the respective countries. The strong connection between the increasing climate crisis and extreme weather events indicates hazards' potential to continue occurring and intensifying. Some changes are happening faster than scientists previously assessed and every fraction of a degree of warming will intensify these impacts.[237]

Aim of the CRI

The CRI aims to visualise how extreme weather events affected countries two years before publication and over the preceding 30 years. It simplifies the aggregation and understanding of climate impacts[238] across different regions and time periods, spotlighting nations that extreme weather events most severely affect. The index aims to contextualise climate policy debates and related policy processes with a view to the climate risks and impacts countries are facing. Apart from the ranking, the index brings forward concrete policy demands and formulates options for taking action, with a particular focus on the UN climate negotiations, debates, and processes on the climate–security nexus at different policy levels, and multilateral fora, such as G7 and G20.

Scope of the CRI

The CRI is a backward-looking index based on past data and giving an indication of 171 countries' realised risks. It is not intended to be used for linear projection of future climate impacts or as a standalone source of information for planning risk management and adaptation measures. The index covers the degree of effect from extreme weather events, including hydrological, meteorological, and climatological events, included

236 A detailed description of the CRI methodology can be found here: Adil et al. 2025: Methodology of the Climate Risk Index. Germanwatch.

237 Otto 2023a.

238 The authors acknowledge that risks and impacts are subject to value judgements and based on cultural and social conceptualisation (see e.g. Farbotko and Campbell 2022).

in EM-DAT. In these categories,[239] the CRI includes the following seven hazards.[240]

1. Hydrological

- Flood (including general, flash flood, riverine flood)
- Mass movement wet (including avalanches wet, landslides wet, mudslides wet, rockslides wet)

2. Meteorological

- Storm (including extra-tropical storm, tropical cyclone,[241] severe weather, tornado, blizzard/ winter storm, hail, derecho, lightning/thunderstorm, sand/dust storm, storm surge, wind action, connective)
- Extreme temperature (including severe winter conditions, heat wave, cold wave)

3. Climatological

- Wildfire (including wildfire general, forest fire)
- Drought
- Glacial lake outburst flood

The CRI investigates hazards and their related impacts[242] and, thus, countries' realised risks driven by extreme weather events. The index includes three hazard categories and seven hazards. Each hazard's impact factor is measured with three indicators, each measured in absolute and relative terms.

6.2 Components and indicators

Table 3: CRI Indicator Overview

CRI Indicators Overview		
1	Losses due to hazard	Absolute losses (in purchasing power parity)
		Relative losses due to hazard (per unit gross domestic product)
2	Fatalities[243] due to hazard	Absolute fatalities (absolute number)
		Relative fatalities (per 100,000 inhabitants)
3	Degree affected[244] due to hazard	Absolute affected (absolute number)
		Relative affected (per 100,000 inhabitants)

239 Following the EM-DAT categorization and definitions.
240 For definitions for all hazards included in CRI, see the method document here: Adil et al. 2025: Methodology of the Climate Risk Index. Germanwatch.
241 Depending on its location and strength, a tropical cyclone can be called a 'hurricane,' 'typhoon,' 'tropical storm,' 'cyclonic storm,' 'tropical depression,' or simply 'cyclone.' Hurricanes are strong tropical cyclones that occur in the Atlantic Ocean or northeastern Pacific Ocean and typhoons occur in the northwestern Pacific Ocean. In the Indian Ocean and South Pacific, comparable storms are referred to as 'tropical cyclones.'.
242 IPCC definition of impact: The consequences of realised risks on natural and human systems, where risks result from the interactions of climate-related hazards (including extreme weather and climate events), exposure, and vulnerability.
243 Fatalities include confirmed fatalities directly attributed to the disaster plus missing people whose whereabouts since the disaster are unknown and, therefore, they are presumed dead based on official figures.
244 Affected is the total number of injured, otherwise affected, and homeless people.

Relative and absolute indicators: While absolute numbers tend to more prominently represent populous or economically capable countries, relative values capture the proportional impacts on smaller and poorer countries. The CRI analysis is based on absolute and relative indicators in order to consider both effects. With double-weighting in the average ranking of all indicators generating the CRI score, more emphasis and, therefore, greater importance is placed on the relative indicators. Identifying relative values in the index represents an important complement to the otherwise often-dominating absolute values, as it allows for analysing country-specific data on damage in relation to real conditions and capacities in those countries. Clearly, for example, damage of USD 1 billion causes much lighter relative economic consequences for richer countries such as the United States and Japan, than for poor countries, where damage often amounts to a substantial share of the annual GDP.

Use of purchasing power parity values for a more comprehensive estimation of how different societies are affected

Absolute losses are counted in purchasing power parity (PPP) values. These values allow for a more appropriate expression of how the loss of USD 1 actually affects people compared with using nominal exchange rates. PPP is a measure of the price of specific goods in different countries and is used to compare the absolute purchasing power of the countries' currencies. For example, this means a farmer in India can buy more crops with USD 1 than a farmer in the United States. Thus, the same nominal damage's relative economic impact is much higher in India.

Influence of economic and population growth on results: It should be noted that values and, thus, country rankings in the CRI regarding the respective indicators may not only change because of extreme weather events' absolute impacts, but also because of economic and population growth or decline. If, for example, population increases (as in most countries), the same absolute number of deaths leads to a relatively lower assessment in the following year. The same applies for economic growth. However, this does not diminish this approach's significance. Society's ability to cope with damage through disaster risk management generally grows as economic strength increases, as greater resources often allow for better preparedness and response measures. Nevertheless, improved ability does not necessarily imply stronger implementation of effective preparation and response measures, or that such measures are applied equitably across different regions or communities in the country.

6.3 Calculating the CRI score

The CRI uses the following procedure for converting raw data into an index and calculating the CRI score, based on the process developed by the EU Competence Centre on Composite Indicators and Scoreboards.[245]

245 European Commission 2024.

Figure 11: Calculating the CRI score

1 Raw data from sources is selected (for sources see References and Annex). Data errors (i.e. tabulation errors coming from the source) are identified and corrected at this stage.

2 An indicator is labeled as ‚missing' for a country, if data that is missing for one or more countries. This particular indicator will not be considered in the averaging process. The raw data was selected to cover a high number of UN countries (see chapter 6.1).

3 The CRI indicators are normalised by determining the distance from the group leader, which assigns 100 to the leading country and other countries are ranked as percentage points way from the the leader.

4 The absolute economic and human loss indicators are weighted 1/8 (12.5%), the relative economic and human loss indicators are weighted 3/8 (37.5%). The human loss indicator consists of fatalities (weighted 3/5 (60%)) and people affected (weighted with 2/5 (40%)).

5 The CRI score is calculated as follows:
CRI score = [3/5 (Absolute fatalities) + 2/5 (Absolute affectedness)] x 1/8 + [3/5 (Relative fatalities) + 2/5 (Relative affectedness)] x 3/8 + (Absolute losses) x 1/8 + (Relative losses) x 3/8

Figure 12: CRI indicators and weighting

Indicators

Fatalities, relative	22,50 %
Fatalities, absolute	7,50 %
Affected, relative	15,00 %
Affected, absolute	5,00 %
Economic losses, relative	37,50 %
Economic losses, absolute	12,50 %

6.4 Time frames

The CRI ranking addresses two time frames. **The short-term ranking** considers impacts of extreme weather events that occurred two years before publication. The two-year interval between events and publication is because of the index's data basis. The data were published in certain cycles. For a publication with a one-year interval, the World Bank dataset as the basis for determining/categorising countries' economic losses would not yet be fully available. The EM-DAT database's data quality also increases with the time lag to the year of the events, as the data is validated and supplemented several times. The two-year interval, therefore, ensures higher data quality and better coverage.

The **long-term ranking** is based on average values over a 30-year period, which was chosen to cover a climate-relevant timeframe. This ranking allows showing of extreme-weather events' long-term degree of effect on countries. It shows the degree of effect by unusually extreme events and recurring extreme weather events.

Table 4: Climate Risk Index time frames

Short-term CRI	Most impacted countries, usually two years before publication (2022 for CRI 2025)
Long-term CRI	Most impacted countries over the preceding 30 years (1993–2022 for CRI 2025)

6.5 Limitations of the index

The CRI does not provide an all-encompassing analysis of countries' realised or future risks of anthropogenic climate change. It should be seen as one analysis, which helps explain countries' degree of effect from climate-related impacts and risks based, on the best publicly available historical data set on extreme weather events' impacts, alongside other analysis.[246]

The index is based on data reflecting current and past natural climate variability and on climate change, to the extent that it has already left a footprint on climate variability over the preceding 30 years.

Hazards and impacts:[247] For collecting data, EM-DAT uses a threshold for defining which events to include in the database. One of the following criteria must be satisfied for inclusion:

- 10+ reported deaths
- 100+ people reported affected
- Declaration of a state of emergency
- Call for international assistance

An international appeal for assistance, however, takes first precedence for entry, even if the first two criteria are not fulfilled.[248]

Due to the EM-DAT collection criteria, events that do not satisfy the outlined criteria are not included in the database and, therefore, also not in the CRI.

Phenomena included in the CRI

Climate change's effects can be divided into two categories in accordance with the temporal scale over which they occur and the differing speed of their impacts' manifestation: slow-onset processes and rapid-onset events. The CRI analysis only incorporates extreme weather (rapid-onset) events, including hydrological events, such as floods and mass movements, meteorological events, such as storms and temperature extremes, and climatological events, such as

246 Notre Dame Global Adaptation Initiative 2024.
247 EM-DAT Project 2022.
248 Sapir and Misson 1992.

wildfires, glacial lake outburst floods, and drought. The CRI does not include slow-onset processes, which are taken as 'phenomena caused or intensified by anthropogenic climate change that take place over prolonged periods of time – typically years, decades, or even centuries – without a clear start or end point.' [249] Slow-onset processes include: increasing mean temperatures, sea level rise, ocean acidification, glacial retreat, permafrost degradation, salinisation, land and forest degradation, and desertification, decreasing precipitation, and loss of biodiversity (see IPCC 2022, UNFCCC 2012, UNU 2017). Such processes cannot be included in this index because of the limited data availability on economic and human effects.

Geological events, including earthquakes, volcanic eruptions, and tsunamis, which are independent of weather, are also not included in this index and, thus, not attributable to climate change.

Level

The CRI compares how countries are affected at the national level. It does not allow for conclusions about damage distribution below that level.

Climate change parameters

The CRI's event-related examination does not allow for assessment of continuous changes of important climate parameters. For instance, the CRI cannot show a long-term decline in precipitation that was shown in some African countries and resulting from climate change. Nevertheless, such parameters often greatly influence important development factors, such as agricultural output and drinking water availability.

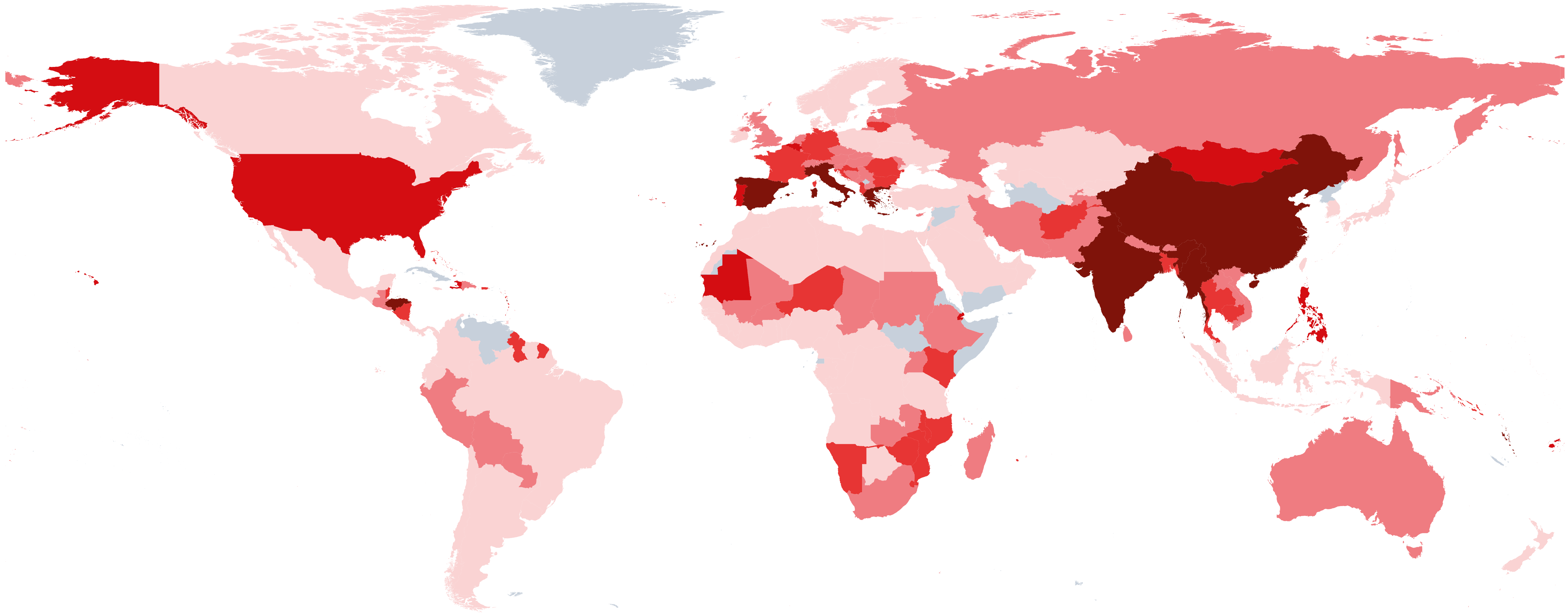
Impacts covered

Lagged impacts that manifest significantly later than an event occurred (e.g. a person's death due to injuries as a consequence of an event's impacts, or downstream economic damage due to the loss of economic buffers or loss of income in the recovery phase of affected people[250]), may not be included in the calculations of the CRI.

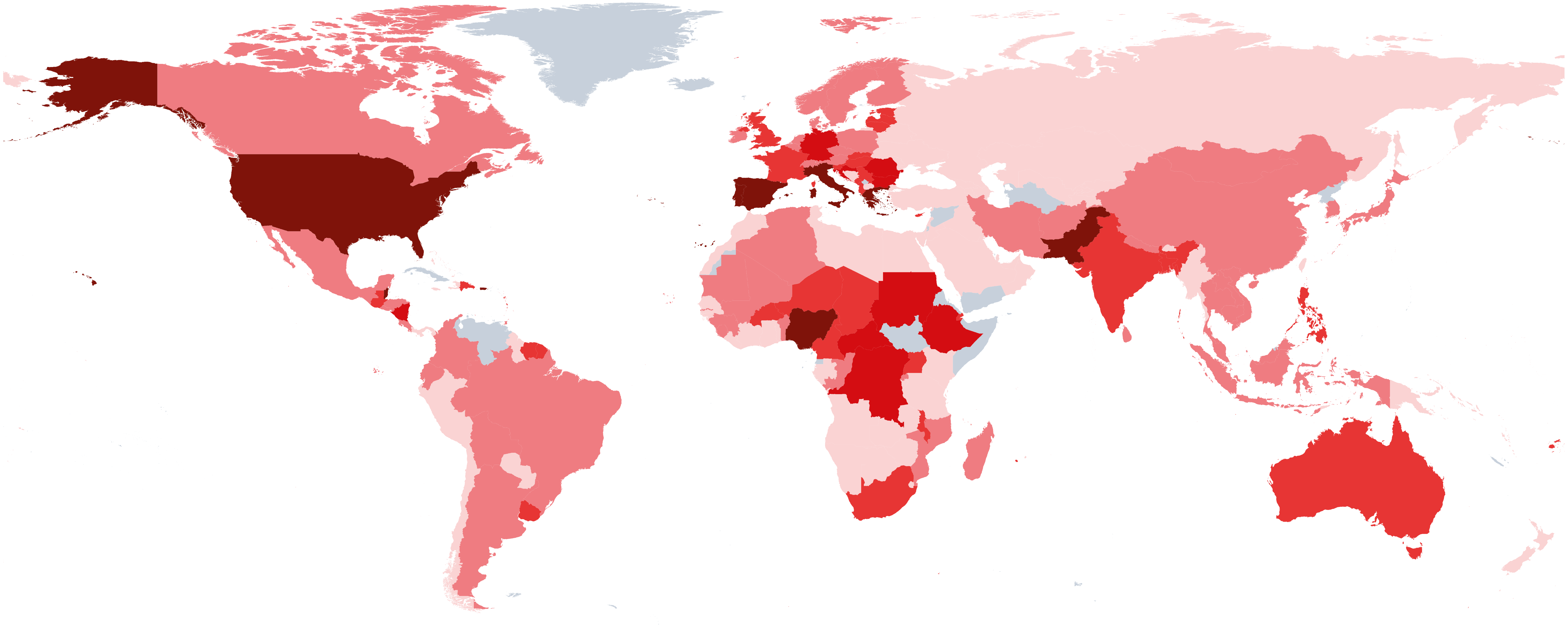
Climate change-related extreme weather events can cause both economic (including [a] physical assets and [b] income) and non-economic losses and damages (including [a] material and [b] non-material forms).[251] The index covers a broad range of economic and non-economic losses and damages. Measuring non-economic loss and damage is particularly challenging. Therefore, the index does not cover some forms of non-economic loss and damage (e.g. loss of heritage, identity and culture).

249 Schaefer et al. 2023.
250 see e.g. Sauer et al. 2023.
251 Serdeczny 2018.

Climate Risk Index: Overall Ranking 1993-2022



Climate Risk Index: Overall Ranking 2022



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